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AIRPORTS & THEIR EQUIPMENT

The AIRCRAFT ENGINEER AND AIRSHIPS

1517 XXXIII

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The AIRCRAFT ENGINEER AND AIRSHIPS

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The Outlook

A Wise Move

IT is safe to say that never, since the formation of the Society of British Aircraft Constructors in 1916, can any event in its history have caused so much speculation in aviation circles as did the announcement last week that Mr. Handley Page had become the Society's first President, and that to the post of chairman of the council had been appointed Sir Charles Bruce-Gardner.

Speculation is rife concerning the duties of the new chairman. They were by no means clearly defined in the official statement issued by the S.B.A.C. and published on p. 56 of this issue. Consequently one is free to interpret the move according to one's own ideas and inclinations.

Fundamentally, the appointment of a paid chairman must be regarded as thoroughly sound policy. In most cases, members of the council of the S.B.A.C., from whom in the past the chairman was elected, have enough to do with looking after the affairs of their own particular firms; and since the expansion the industry's particular problems, plus the liaison with the Air Ministry, have become a whole-time job.

Apart from this, there are obvious advantages in having as chairman of the council a man who is entirely unbiased and with no personal interest in any one firm in the industry. This is no reflection on those chairmen of the Society who have, up till now, given so freely and unstintingly of their time, often sacrificing self-interest for the good of the Society. Thus, one may accept the appointment of an executive chairman, particularly of one taken from outside the aircraft industry, as a wise and timely move.

Dictator or . . . . ?

THERE has been a tendency in some quarters to jump to the conclusion that the new chairman of the S.B.A.C. is to be given dictatorial powers, so that in cases of dispute he can give an overruling decision. The term "executive" chairman scarcely justifies this assumption. Cynics have pointed out that Sir Charles Bruce-Gardner was, in the past, closely associated with the Bank of England, and that the new move was the S.B.A.C.'s clever way of forestalling any possibility of a future nationalisation of the British aircraft industry. One need not take this view very seriously. In fact, one might reply by quoting the fact that Sir Charles was also, among his many past activities, once chairman of the Galvanising Conciliation Board, and that there is likely to be need for both galvanising and conciliation in his new job.

Be that as it may, the idea of a dictator is rather dispelled by the wording of the official announcement, which states that the new chairman will "conduct the affairs of the Society in accordance with the policy settled by the Council," and that "he will be particularly concerned in interpreting to the Air Ministry and to the industry the views and wishes of one to the other."

Of all the comments which have been published on the subject, the Aeronautical Correspondent of *The Times* probably put it nearest the truth, and certainly most neatly, when he wrote "The British aircraft industry has provided itself with an ambassador, already skilled in solving industrial difficulties, to serve as principal negotiator between the industry and the Government and to help the industry in laying long-term plans."

Developing Civil Aviation

PARTICULARLY welcome is the statement in the official announcement that the new chairman will be primarily concerned with "ensuring the well-being of the industry in the development of civil aviation and export trade." Under the stress of military expansion, British civil aviation has been somewhat neglected during the last few years; naturally and inevitably so. The defences of the country must come before commercial development in times of emergency. But one may hope that when production has caught up with requirements, time and opportunity will be found for giving to civil aviation that careful attention which has been denied it for some years; and if that is to be done effectively and without loss of time, it will be necessary to plan carefully and well ahead. The past experience of Sir Charles Bruce-Gardner is such that one is justified in believing that if the problems with which he will be faced during the next few months are capable of solution, he is the right man to solve them.

Airports—The Real Problem

THE fact that the take-off and landing characteristics of modern transport aeroplanes are, so to speak, outstripping those of many of the aerodromes of which they may be expected to make use is a source of considerable heartburnings in municipal and other quarters.

The trend towards larger and faster machines was a quite inevitable one, and there is no reason to deny the possibility that these machines will grow even bigger and faster. Unless certain quite vital changes are made in aircraft design, particularly in relation to flap gear, it is equally reasonable to suppose that accelerations will be less marked and that longer and longer runways will be necessary. In this connection it should also be remembered that many of the present-day low-wing machines are helped by what is known as ground effect, so that, even if the take-off run is comparatively short, the distance travelled before the real climb can be started is often quite considerable.

Already airport requirements have outstripped those which were laid down a few years ago—particularly in the matter of what may be called engine-failure safety. There is a certain interval between the moment of take-off and the attainment of what may be called a single-engined speed at which a machine may be considered to be safe even in the unlikely event of the failure of one unit. It is necessary, therefore, to retain, in hand, an additional stretch of airport for use in the interim period, so that failure immediately after the take-off will not mean that there is no more space on which the machine can be safely landed.

Future Requirements

DURING an address which he recently delivered to a mayoral conference, a U.S. official stated that the very latest American transports now on the stocks might not be able to use more than five or six of the airports in that country.

This was a statement of considerable importance, since the same might be said in our own case. However, it is improbable that the largest machines will need to use more than three or four of the most important terminals in any one country. Smaller machines, with a lower cruising speed and, consequently, a better take-off and a slower landing speed, will inevitably be used for feeder-line work.

In years to come all the larger cities in the world will find a need for at least two aerodromes, one of a fully controlled nature for transport operations, and the other for private owners, radioless charter people and similar small fry. In fact, this applies already in the majority of cases, and the only eventual need will be to segregate the species rather more firmly. No machines without radio equipment, and perhaps no machines other than those used for public transport, will eventually be permitted to enter the area surrounding a city's main airport.

National Planning

SO far as requirements are concerned, it is obvious that any planning must be done on a national and perhaps even an international scale. The Maybury Committee went some way towards formulating such a plan, and until the country's airline system has settled down it is difficult to see that anything else can be done. Nevertheless, the municipalities are already groaning and grumbling under the financial loads which they are expected to bear in the interests of the progress which may or may not eventually benefit them individually. Their complaints can be the subject for sympathy, even if we feel that progress as a whole demands some special and unselfish effort.

It is natural that at this stage even the most public-spirited municipality requires the formulation of a definite national policy in order that a reasonable degree of certainty may be felt. No public body will seriously mind the possession of an aerodrome which does not appear to be used to its fullest extent if this body feels that their effort is part of a plan which will eventually arrive at fruition.

In the meantime a technical committee might be formed to make an accurate study of present and future requirements in the matter of aerodrome size, this committee to be composed not of legal-minded professional speechmakers but of men who really understand the problems involved and who are keen to get the job done.

Better Late, Perhaps . . . .

IT is seldom possible to encourage the people who have to do a particular job of work to get up and say what they really think about modern navigational aids. Sqn. Ldr. Blucke's paper (a summary of which is given on pp. 58-60) was, therefore, of particular interest. He dealt with the experiments which had been made at Farnborough on two separate blind-approach systems.

Nevertheless, it is almost pathetic to realise that only at this very late date has the Air Ministry seen fit to make any experiment on these lines. Apart from certain more practical points, almost everything which was said by the lecturer, no doubt with official approval, could have been said equally well by a large number of German and Swiss pilots two or three years ago. It is three years since what is now commonly known as the Lorenz system was described in this paper, and nearly two years since a member of *Flight's* staff actually tried out the system for himself at Heston.

On this test he found that the glide-path indicator, which was rather severely criticised by the lecturer and during the discussion, could be made to work, and at that time Continental pilots had already developed a method of using this indication to the best advantage. We have been criticised from time to time for speaking of the system as one for blind landings, yet we agree entirely with Mr. Denman in his statement that, whatever the unreliability of the vertical guidance, the deformed beam at present provides the only potential assistance towards the actual landing in conditions of no visibility.

On the whole, the discussion was disappointing, and only one pilot—and that from Imperial Airways, who have only recently taken any practical interest in blind approach systems—was prevailed upon to say a word or two. For the rest the speakers wrangled over unimportant points, and only one suggested that all the radio technical experts should get together and make, in the words of the previous paragraph, the best of the assistance which has already been developed. Incidentally the second system, which was described in such detail by the lecturer, appears to have been more or less turned down by the American transport operators many years ago simply because it showed no possibility of eventual value in really zero conditions. At that time the ultra-short-wave track system was given considerable praise, and it was this system which was developed by the Lorenz and Telefunken people for practicable use in regular transport operations.

The Long-Range Flight

THE R.A.F. attempt to recover for Britain the world's record for a non-stop flight is to be made by four Vickers Wellesleys flying in formation, each manned by a crew of three. As supplied hitherto to squadrons, the Wellesley is a two-seater, but to fit a seat for a third man in the rear cockpit would be a straightforward job. Each crew will consist of an officer pilot, an officer navigator, and an airman pilot who is a qualified wireless operator mechanic. On a non-stop flight an ordinary fitter is not needed, but it is essential that the navigation should be accurate and that the wireless should function reliably. It is also desirable that the first pilot should be relieved now and again.

The flight will most probably be made in the direction of Australia, and a record of 8,000 miles will doubtless be the aim. The names of the chosen are: Pilots, Sqn. Ldr. R. Kellett, Flt. Lts. H. A. V. Hogan, F. S. Gardner, A. N. Combe; Navigators, Flt. Lts. R. T. Gething, B. K. Burnett, F/O.s R. G. Musson and G. J. D. Thomson; Airmen, Flt. Sergt. M. L. Caine, Sergts. H. B. Gray, T. D. Dixon, and G. Gibbs.

This is the first attempt on a long-distance record by a formation of four machines, and that fact will make success, if it is achieved, extremely convincing.

CONTINENTAL JUNCTION

The challenging 984 feet of the Eiffel Tower, the leisurely winding of the Seine and the nobility of great buildings conspire to make this outstanding aerial picture of—need we say?—Paris.

ORGANISING FOR SAFETY

Modern Air Traffic Control Methods : Likely Changes : Reducing Personal Responsibility : Croydon's System Described

By H. A. TAYLOR

ALTHOUGH air traffic congestion is at present only really noticeable, as far as this country is concerned, in the Croydon area, where all the Continental and many of the internal services converge, the need for a co-ordinated traffic system covering the entire country is obviously pressing at least in order to prepare for the future. Early last year it seemed that certain drastic changes were due to be made, but so far the only official sign of such changes has appeared in the decision eventually to instal specially trained Air Ministry control officers at all the radio control centres, and the appointment of an inspector of air traffic control who will look after the entire system. For the moment the three communication areas designed to cover the south-eastern part of the country remain unaltered, but during the year a fourth communication area was arranged to cover the Irish Sea district.

It would still seem that the obvious course would be to have a central control office to look after the whole system, the specially selected officers there being in direct and immediate communication with the separate terminal aerodromes. This office might plan the movements and altitudes of the different machines on their various routes, while the individual control people at the terminal airports would take over after the machines had entered each particular controlled zone—thereafter the safety of these machines would no longer be the responsibility of the central office.

All of which is very fine in theory, but might or might not work so well in practice. At the moment the position of the various municipal authorities to whom Air Ministry officials have been, and are to be, delegated is a peculiar one. The aerodromes are owned, and have been paid for by the municipalities, and the new officers may at any time order special equipment or the erection of special extensions in order that they may be able to carry out their work efficiently and well. The Air Ministry, so far as finances are concerned, is only legally responsible for the radio equipment, but it seems that the Government will, after all, be paying directly or indirectly for such extensions. In these circumstances the controlled airport should be better off than the others. Furthermore, the system which has been outlined, if it is not brought in gradually, may cause a certain amount of dislocation in its earlier stages, whereas the more happy-go-lucky methods at present in use still work extremely well.

The expression "happy-go-lucky" should not be taken as suggesting inefficiency, but merely that the system as it stands has been built up very largely by the more experienced control officers themselves, and that its success depends almost entirely on these men's own initiative. A more carefully co-ordinated scheme might help to relieve the separate officer's personal responsibilities and, consequently, to make the possibility of mistakes an even less likely one. Harassed as they are by a number of smaller matters requiring immediate attention and by the needs of various aircraft crews who are either waiting their turn to land in bad weather or waiting for permission to take off, the control officers must, at the same time, look after a number of other machines which are, in fact, well outside the danger areas. The object of any modifications to the system will, in fact, undoubtedly be such as to make the whole thing a good deal more automatic and less dependent on personal inclinations.

However, whatever may be the details of any new scheme, the basic methods of traffic control are likely to remain unaltered. Briefly, the country is divided into certain sections which are known as communication areas, each having its central control. In point of fact, there are, as already mentioned, only four of these areas and the greater part of the country is uncontrolled.

In addition to the control centres some of the other radio-equipped aerodromes, both inside and outside the area, have what is known as controlled zones. No machines may enter these zones without previously obtaining permission from the control concerned, and in this way the possibility that half a dozen machines, each crammed with, possibly, frightened passengers, might, in conditions of bad visibility be approaching one spot at the same time, is largely nullified. These zones, which are formally outlined, are not considered as being in existence unless the weather conditions are such that the horizontal visibility is less than 1,000 yards and the vertical visibility less than 1,000 feet—

conditions alluded to by the powers that be as "visibility 3 minus" and described by the familiar code group QBI. In normal conditions a transport pilot's height and course are largely left to his own discretion, though each is expected to report his position and height at reasonable intervals in order that the control concerned may keep track of the movements of all the machines in its particular area.

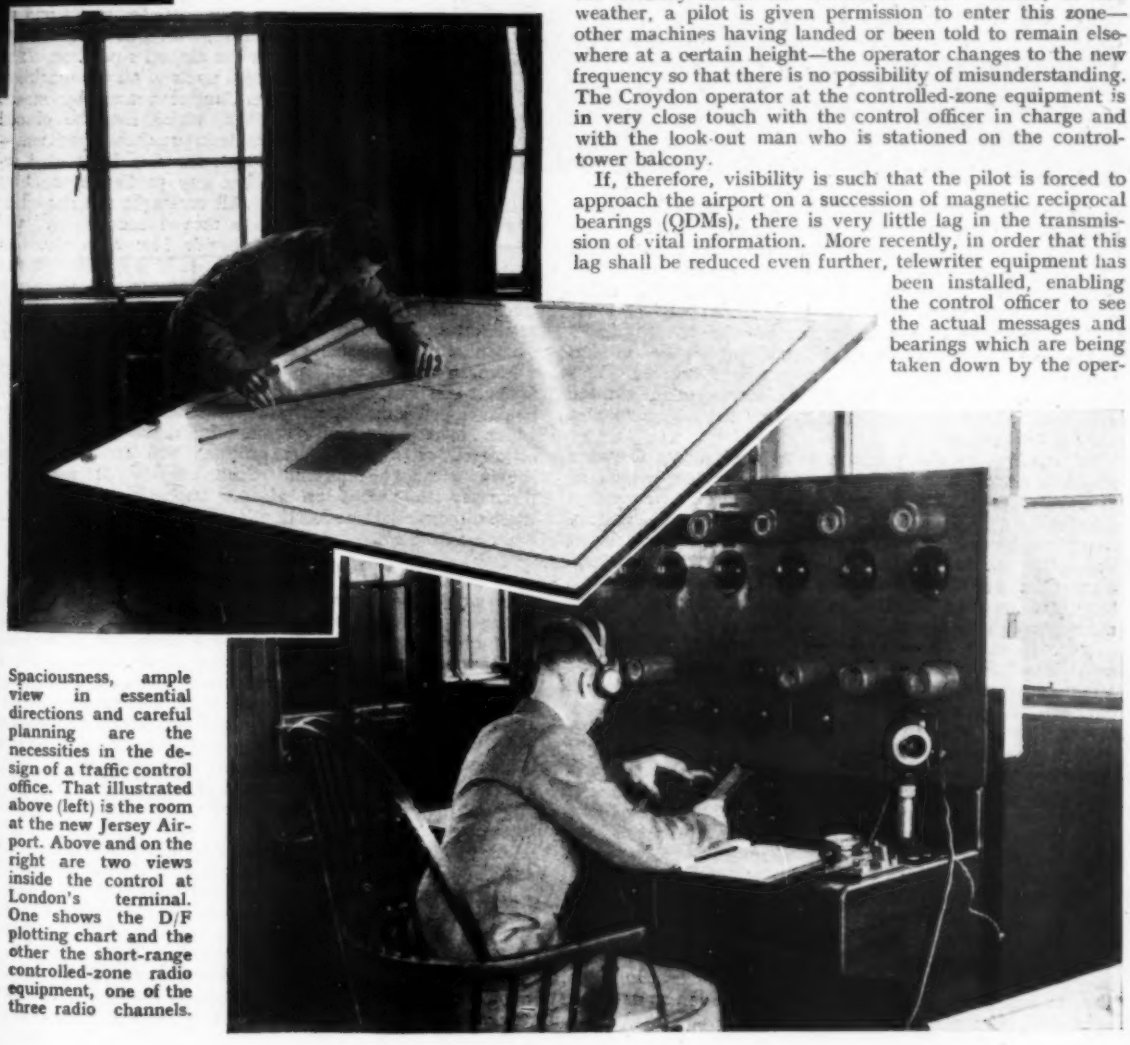
Croydon, as the only airport which, until a few years ago, handled any considerable amount of air traffic was, very naturally, the first to be provided with one of these imaginary zones. Others have been arranged elsewhere as traffic conditions demanded. A year or so ago, for instance, Gatwick had its own zone bordering the London-Continent airway area, but with at least the temporary cessation of transport operations at this centre, this is now no longer in action. The first "outside" zone to be established was that surrounding the Leeds-Bradford aerodrome at Yeadon, and this, in common with other zones since established, consists of an air space up to 3,000 feet above sea level and covering an area bounded by a circle of five miles radius centred at the aerodrome. So far the only exception to this rule (apart, of course, from the zone at Croydon) has been that recently established at Ronaldsway, Isle of Man, in which the circle has a ten-mile radius. Other zones will, no doubt, be established from time to time as conditions warrant such arrangements.

The present control system has been developed from the very early days at Croydon, and the methods in use there may, for the purposes of explanation, be treated as those applying everywhere, though local conditions will naturally demand minor modifications. With the idea of standardising such methods to a very large extent, a control officers' school was established some time ago in London, and the officers, many of whom are ex-transport or Service pilots, have been sent out first to Croydon or Heston, to gain practical experience, and thence to the various other control airports in different parts of the country. Mr. J. Jeffs, one of the very first control officers to be appointed, has been in charge of this school, and he is now the previously mentioned inspector of air traffic control. In this capacity he will, no doubt, visit the various aerodromes in order to ensure that the system, as it develops, is fully co-ordinated, and is working, so far as possible, quite automatically.

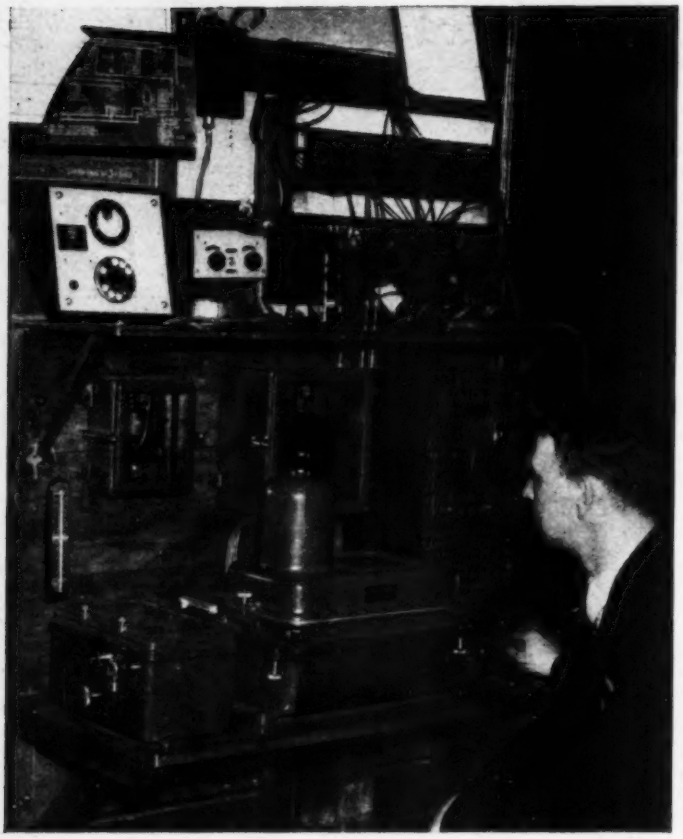
The Three Channels

At Croydon there are three separate two-way radio sets, each working on a different frequency, and one of them designed solely for short-range work with machines which are actually inside the controlled zone. When, in bad weather, a pilot is given permission to enter this zone—other machines having landed or been told to remain elsewhere at a certain height—the operator changes to the new frequency so that there is no possibility of misunderstanding. The Croydon operator at the controlled-zone equipment is in very close touch with the control officer in charge and with the look-out man who is stationed on the control-tower balcony.

If, therefore, visibility is such that the pilot is forced to approach the airport on a succession of magnetic reciprocal bearings (QDMs), there is very little lag in the transmission of vital information. More recently, in order that this lag shall be reduced even further, telewriter equipment has been installed, enabling the control officer to see the actual messages and bearings which are being taken down by the oper-



Spaciousness, ample view in essential directions and careful planning are the necessities in the design of a traffic control office. That illustrated above (left) is the room at the new Jersey Airport. Above and on the right are two views inside the control at London's terminal. One shows the D/F plotting chart and the other the short-range controlled-zone radio equipment, one of the three radio channels.



Inside the Mitcham omni-directional beacon which, used in conjunction with a similar transmitter at Schiphol (Amsterdam), should help to relieve radio congestion in the London-Continent airway area. The photograph shows the automatic control.

ator—or *vice versa* in the case of requests from the control to the pilot of the machine concerned. Another small lag-reducing innovation consists of the placing, at a convenient place on the control-tower balcony, of a series of marked switches which are connected to a similar series of lights in the radio operators' department. With its help the look-out man can tell the operator at once whether the machine's motors can be heard and from which direction, the switches and lamps being marked in the appropriate manner. This information can thus be handed on to the pilot, via the operators, with the minimum delay for the adjustment of his final approach.

In addition to the medium-wave equipment, Croydon now has an ultra-short-wave approach beacon, which is, of course, controlled from the tower, where its control panel acts also as a repeater, the correct functioning of the main beacon and of the two marker beacons being shown by means of signal lamps. Two other approach transmitters are also installed near the aerodrome boundary, but these are used only for experimental purposes by the radio people concerned.

More recently—in fact, during the past few weeks—an omni-directional beacon has been put into action near Mitcham, where the transmitting station for Croydon is situated. The problem of traffic control during busy periods is only equalled in its seriousness by that of radio congestion on the available wavebands, and the beacon at Mitcham provides an attempt to reduce the number of messages which are being received and sent. Needless to say, this beacon can only be useful to the crews of machines fitted with some form of D/F or homing equipment, and the congestion problem can, in fact, only finally be settled by the standardisation of the radio and other equipment actually carried by the machines. For the moment only the most modern transports carry the necessary equipment to make use of a transmitter of this kind or of a short-wave approach system, by such means reducing the necessary communication to a mere statement of position from time to time and to the reception of permission to enter the controlled zone and to land.

Croydon's direction-finding system is actually arranged in the control tower itself, but many other airports have this equipment placed well outside the aerodrome boundary. In fact, Croydon's equipment is of the loop type, which has the advantage of compactness, while the aerial system necessary to reduce night error effects to an absolute minimum covers quite a considerable area and may form a not unimportant obstruction. Such is the price of accuracy. With the D/F equipment placed as it is at Croydon, however, it is not practicable to make approaches by what is known as the "ZZ" system, which involves very accurate flying methods and the placing of a D/F hut on or near the aerodrome boundary. It seems possible that equipment will be so placed at Croydon in due course, and possibly within the next few months.

So much for the radio side of air traffic control. The more technical features and the likely future developments are adequately dealt with in an article by Mr. Samuelson which appears elsewhere in this issue.

In the control office itself there is a large map of the Heston, Portsmouth, and London-Continent airways areas, with a bearing "rose" having its centre at the airport's position. The officer in charge keeps track of all the machines within the London-Continent area by means of identification flags, which may be pinned into the board at their approximate positions—the direction in which the flag is pointed reminding him whether any particular machine is inward or outward bound. All messages are passed to him by the operators, the flags moved accordingly, and these messages carefully filed beside him in a series of "open" pigeon-holes. If, in the case of a machine which has its own very full navigation equipment, no message is received for a long period, the identification flag is moved now and again according to the control officer's own estimation of its probable progress.

Modern speeds tend to make this estimation rather a difficult business, and it seems likely that there will need to be developed some kind of automatic indicating machine on which, once a machine's ground speed has been correctly estimated or reported, its progress will continue to be shown without attention. Unfortunately, it would be necessary to invent an almost impossibly complicated three-dimensional model if all the facts concerning each machine were to be indicated.

Necessary Experience

It would be impossible to describe in detail all the duties of a control officer of a busy airport, but it is at least obvious that he must have a very full knowledge and experience up to Second-class Navigator's standard. To mention one detail which is not often considered by the ordinary person, he must visit the meteorologist's office before coming on duty and so obtain a working knowledge of the conditions likely to be experienced within his area during his period of duty. At Croydon all the inter-office messages and general information are transmitted through the building by means of the familiar pneumatic tube.

Although there is, on the control officers' desk, a miniature D/F plotting board, the main board on which all bearings and positions are obtained is necessarily located in the radio-operators' department. In the case of Croydon the points of reference are Croydon itself, Lympne and Pulham, and strings to which are attached little lead "mice" may be moved from these three points on the operators' chart in order to obtain a machine's position. Nowadays such positions are very rarely required by

THE CONTROL SYSTEM AS IT IS TO-DAY

The Communication Areas, Controlled Zones and Radio Stations at Present in Operation

pilots, who prefer to work out their own little problems following the receipt of bearings from one or two radio stations on or near their routes. To the pilot of a modern transport cruising at 160 miles an hour or more a "fix," even if this can be obtained, as it can within a minute and a half of the request, is not a great deal of use. The knowledge that he was over Lesser Puddleton two minutes previously is not really very helpful. It is interesting, however, to find that it is now a rule that the three stations mentioned shall take a bearing on every machine which is transmitting, whether these bearings are asked for or not. They are all passed on to Croydon, so the control there is able to obtain a better idea of the progress of each machine.

Modern ideas in matters such as airport lighting have no place in an article dealing with traffic control, but it is, nevertheless, necessary for the officers to know exactly which floodlights should be used in certain circumstances and whether all the obstruction lights and so forth are functioning correctly. For this purpose there is in the control office a lighting repeater-panel on which the control officer can see at a glance whether everything is as it should be. Croydon has recently obtained an up-to-date example of such equipment, though this is not yet in use, and will shortly have a wind-tee repeater which will enable the staff to make the best use of the panel. In conditions of no wind this repeater can be used to set the tee, by remote control, in a certain pre-arranged position indicating the official maximum-run, or flat-calm landing direction.

Ground control, though not quite so spectacular, is equally important, particularly in these days when blind take-offs and almost-blind landings are more or less customary. At Croydon permission to leave the tarmac in the ordinary way is indicated by the display of a panel on the tower which bears an appropriate letter, or, in the case of an odd machine, the letter "X." After he has reached his selected take-off point permission to open-up is given by means of an Aldis lamp, and if, for any reason, the pilot delays his take-off and another machine is about to land, this permission is retracted by use of a red light from the same device. As for really bad conditions, it can only be remembered that, on a number of occasions, pilots have, after landing, used D/F in order to find their way to the tarmac. The ground control problem may eventually become quite acute, and it may be necessary to institute very rigidly enforced taxying rules—with a perimeter strip for the purpose.

S.B.A.C. "AMBASSADOR"

Appointment of New Chairman to Co-ordinate Interests of the Industry and Air Ministry

Sir Charles Bruce-Gardner

[Elliott and Fry

FOR the first time in its history the Society of British Aircraft Constructors is to have a permanent, paid chairman of its council. The official announcement was made last Thursday that Sir Charles Bruce-Gardner has been appointed to the post. Mr. F. Handley Page, who was chairman of the council, has resigned from that post and has been elected president of the Society, an office which did not previously exist.

The new chairman's duties will be important and wide in their scope. To say that he will act as a liaison officer between the aircraft industry, the Air Ministry and others, would be to understate the case; he can, perhaps, be more graphically described as an "ambassador" representing the industry and charged with the delicate and responsible mission of adjusting the manifold problems which have arisen from the expansion scheme.

Official Announcement

On page 49 will be found Editorial comment on the appointment, the S.B.A.C.'s official announcement of which is as follows:—

"The Society of British Aircraft Constructors was organised in 1916 to deal with war-time production problems and the many matters affecting the aircraft industry. It has since acted as the executive and consultative body in such matters of principle as are of general concern to the aircraft industry. Its affairs are conducted by a Council composed of nominated representatives of the leading British aircraft and aero engine manufacturers, and the Council has hitherto been presided over by a chairman elected from its members.

"The requirements of the Royal Air Force programme and the increased demands upon the elected chairman in his dual capacity as manufacturer and as head of the Society, have led the Council to take the important step of appointing an executive chairman of the Society from outside the industry. Consequent on this appointment the new office of President has been created to which a member of the Council will be elected instead of to the post of chairman as heretofore.

"Mr. Handley Page, who was elected chairman in May, 1937, will be the first President of the Society under its altered constitution.

"The Council of the Society has appointed Sir Charles Bruce-Gardner to be the new chairman.

"Sir Charles Bruce-Gardner will conduct the affairs of the Society in accordance with the policy settled by the Council. He will be particularly concerned in interpreting to the Air Ministry and to the industry the views and wishes of one to the other, and ensuring the well-being of the industry in the development of civil aviation and export trade.

"Sir Charles Bruce-Gardner has had a long and varied industrial experience. He was trained as an engineer and was for many years director and managing director of companies engaged in the iron, steel, coal and other industries. He was chairman of the Flintshire Coal Owners' Association, of the Galvanising Conciliation Board, of the Iron and Steel Research Council of the British Iron and Steel Federation, and other industrial organisations.

"In 1930 he resigned his other interests on accepting an invitation to become managing director of Securities Management Trust, Ltd., and a director of the Bankers' Industrial Development Co., Ltd., and of Credit for Industry, Ltd., organisations formed under the auspices of the Bank of England.

"The Governor and company of the Bank of England have kindly agreed to the resignation of Sir Charles Bruce-Gardner from these posts on his taking up his new appointment."

New School at Rochester

THE Air Ministry has entrusted to Short Brothers the task of establishing a flying school at Rochester Airport. The original intention had been that it should be a Reserve school, but, ultimately, it was decided to make it a school for training Regular officers also, so that Rochester is likely to see a great deal of activity in the near future.

In this connection it is interesting to recall that Short Brothers' flying school at Eastchurch was one of the earliest to be established in this country, and that many of our very earliest pilots were trained there.

The D.H. Staff Dinner

THE annual dinner of the De Havilland Aircraft Co., Ltd. (Aircraft Division), was held at the Addison Restaurant, Olympia, London, last Saturday, some 700 being present. An account will be given in next week's issue.

THE FOUR WINDS

ITEMS OF INTEREST FROM ALL QUARTERS

TROOPER-TANKER : The hose reel on the A.W. 23 troop carrier now being used by Sir Alan Cobham for refuelling experiments on the South Coast. An Empire boat has already acted as refuellee.

IT is suggested in Lanarkshire that colliery dumps should be spread to fill uneven, low-lying ground and so form the basis of aerodromes.

Shorts were not the least bit apprehensive regarding the Mayo Composite during the ravaging winds of last week-end. With *Mercury* perched high in the air the combination rode the Medway in true Short style.

It is expected that Scottish property owners will institute a scheme of mutual insurance against loss by aerial bombardment in the event of a war.

Consignments of cut flowers have lately been flown via Imperial Airways to Egypt, having been sent, in some instances, from Holland to England by ordinary transport.

A Potez 25 with the experimental Clerget diesel radial of 500 h.p. has climbed to 24,950ft. A supercharger of Gnome-Rhone type was fitted.

Russia's fire brigades composed of parachutists, used to fight forest fires, have proved so successful that they are to be enlarged.

The Focke-Wulf Condor, described in *Flight* of December 23, 1937, recently carried twenty-five German journalists from Berlin to Cairo, by way of Athens, at an average speed of 205 m.p.h.

The five Londons of No. 204 (G.R.) Squadron were given an enthusiastic reception at Port Darwin last Sunday afternoon. They had been delayed by bad weather for one day at Koepang.

Sir Hubert Wilkins, while searching for the Russian airmen lost in August on a trans-polar flight, recently flew over a stretch of some 1,400 miles in a temperature of 40 deg. below zero.

Among new American aero engines are a seven-cylinder Lycoming giving 220 h.p. for take-off and a 50 h.p. Continental flat-four weighing approximately the same as the well-known Continental A-40 (40 h.p.) as fitted in the Hordern-Richmond Autoplane.

The beautiful Amiot 370 which, flown by Rossi, is to attack the 2,000 km. record with loads of 500, 1,000 and 2,000 kg. now held by an Italian Savoia S.79, is to be fitted with two special Hispano Suiza 12Y engines of about 1,000 h.p. each.

Mr. Charles Putnam, Junior, has announced that his schooner is being fitted out at San Francisco and will sail early next month to search the South Seas for Miss Amelia Earhart Putnam, who disappeared while flying the Pacific last July. Mr. Charles Putnam is not related to Mr. George Putnam, Miss Earhart's husband.

Figures from flight tests show that the new Lockheed 14 (two Pratt and Whitney Hornets) with Lockheed-Fowler flaps requires 217 yards for take-off in still air, the run occupying 13 seconds. The landing run is 65 yards, and the sea-level climb 1,490 ft./min. At 7,000ft. the top speed is 246 m.p.h. and at a cruising speed of 227 m.p.h. at 12,000ft. the range is 1,950 miles.

Twenty-five Years Ago

(From "Flight," January 18, 1913.)

"As witness of the fact that the backwardness of the Royal Flying Corps is not due to any lack of enthusiasm among the officers themselves may be taken the keen interest which is being evinced in the proposal that No. 2 Squadron, which has been ordered to the new station at Montrose, should make the trip from Farnborough by the airway."

BLIND TRANSPORT : With the cockpit completely screened a T.W.A. pilot takes his regular blind-flying test (demanded every 90 days) under the eye of one of the line's chief pilots.

PRACTICAL BLIND APPROACHES

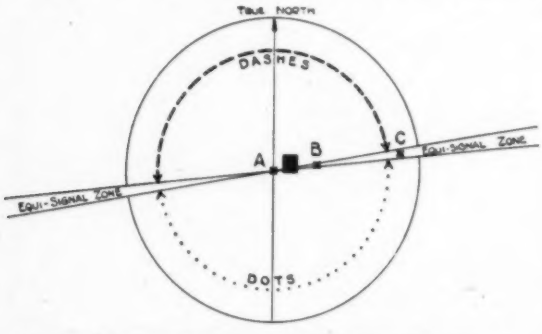
Radio as a Direct Aid in Bad-weather Approaches : A Summary of Sqn. Ldr. Blucke's Paper Read Before the R.Ae.S.

IN introducing last Thursday's lecturer at the Royal Aeronautical Society, Prof. G. T. R. Hill said that Squadron Leader R. S. Blucke, A.F.C., had spent the last twenty years in the Service and had recently been in command of the Radio Experimental Section of the R.A.E. at Farnborough, and added that, in conformity with the usual Air Ministry system, he had been transferred to the Bomber Command at Uxbridge just when his experience should be most valuable in the work on blind-approach technique and development.

Sqn. Ldr. Blucke, in his foreword, mentioned that the earlier experimental attempts at reaching an aerodrome in conditions of bad visibility had been concentrated more on the actual landing than on the approach. Nowadays the approach problems had, to a large extent, been solved, but the final touch-down was still a difficulty. He pointed to the use of the word "direct" in the title of the lecture, and explained that it was meant to differentiate between the system whereby a pilot received radio bearings from the aerodrome control organisation and that whereby a pilot, by operating a radio set under his own control, could receive signals either aurally and/or visually from transmitters situated on the ground in such positions that the indications received would enable him to find his own way into the aerodrome. Once he had received permission to land, therefore, he could dispense with the assistance of the control organisation.

The Farnborough Experiments

Before describing a pilot's impressions of the two systems which had been used for experimental purposes at Farnborough, Sqn. Ldr. Blucke dealt with the instruments which must be carried if blind approaches were to be successfully carried out. He particularly stressed the importance of the directional gyro which permitted very accurate flying after the beam had been picked up. (This was an interesting admission, since the Air Ministry has, until comparatively recently, looked upon all free gyro instruments with a certain amount of misgiving.) Apart from this directional gyro and the more normal flying instruments, it was necessary to use an artificial horizon, a rate-of-descent indicator, and a sensitive altimeter, the latter with a millibar correction scale in order that the barometric pressure at the aerodrome level might be set before making a final approach. He placed the turn indicator last on his list because a blind approach demanded very precise directional flying which was not possible with such an instrument, but added that it was of the greatest value in synchronising



Description	Frequency in Megacycles	Wavelength in Metres	Modulation Frequency of note emitted	Comparative Pitch	Signals per Second
A-Main Beacon	33·3	9	1150	Medium	Continuous in Equi-signal zone
B-Inner Marker	38	7·89	1700	High	6
C-Outer Marker	38	7·89	700	Low	2

A diagrammatic plan of a typical Lorenz signal plan—actually that at Heston.

The instrumental equipment of one of the Monospars used at Farnborough for blind-approach experiments. The special millibar correction scale on the sensitive altimeter is interesting and it may be possible to read the notice above it which orders that two millibars should be added to the barometric pressure given. Two millibars are, in fact, equal to 60 feet at sea level. An altimeter-guided approach has its dangers.
(Crown Copyright Reserved.)

the directional gyro and compass, and in making accurately rated turns.

Two systems were used during the experiments—one using the track beacon and the other using a radio compass. In the case of the former a beam was laid down by a transmitter on a predetermined track and the machine carried receivers with suitable indicators to inform the pilot of his position in relation to this beam. The Lorenz system was the best known of those in this category. With the radio compass system this instrument was used to home on two specially placed transmitters again on a predetermined track. Capt. Hegenberger, of the U.S. Army Air Corps, had conceived and tested it. In each system accurate position indications were given by means of marker beacons which emitted a vertical sheet of radiation at right angles to the correct track. Vertical guidance could be given in the case of the track beacon by means of an indicator which was operated by the vertical components in the beam. Alternatively this could be provided by a sensitive altimeter.

Before describing each system in greater detail Sqn. Ldr. Blucke said that the times and speeds given were for the Monospar S.T.25 used in the experiments, and stressed the fact that it had been assumed that the machine carried no other radio assistance in the form of D/F or otherwise. He described only the sensitive altimeter technique in the matter of vertical guidance.

The details of the Lorenz system consisted of a main beacon with a radiation through 360 deg. and two marker beacons. The main beacon, transmitting on 9 metres, was situated on the extreme edge of the aerodrome and projected, by means of reflectors, an equi-signal zone of about 4 deg. in width. By suitable keying of the reflectors, dots were produced on the left sector and dashes on the right sector. Situated down the centre of the approach line were the two low-power 7-metre marker beacons. Usually the inner one was placed on the aerodrome boundary while the outer one was about one-and-a-half miles away. Receiving apparatus was fitted in the machine to enable the signals to be received either aurally or visually from the main marker beacons.

When flying in the beam in the predetermined approach direction, the pilot would receive a steady signal in his ear-

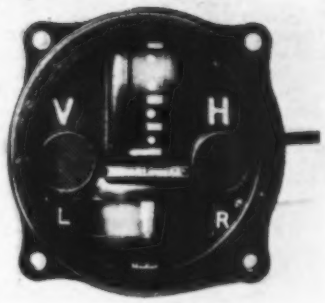
phones, which would change into dots when flying on the left of the beam and dashes when flying on the right. When passing over the outer marker, he would receive signals of a low pitch at a rate of two per second superimposed upon the main signal; and on passing the inner marker high-pitched signals would be heard at the rate of six per second. In addition, visual indicators were provided in an instrument on the dash, one consisting of a moving pointer which flicked towards the direction of the centre of the beam when the aeroplane was heading approximately towards the main beacon in the correct direction. This remained stationary when the machine was actually in the centre of the beam. Two Neon lamps glowed when, in turn, the appropriate marker beacon was passed.

In making his approach the pilot set his course so as to reach a point about five miles down the beam, while synchronising the directional gyro with the magnetic compass. The receiver was then switched on and the pilot might hear either dots or dashes according to his position. He maintained a steady course until the dots or dashes started to disappear and then turned immediately on to the predetermined approach bearing of the beam and held the machine steady. By combining the gyro reading with the note on the headphones, the course could be maintained. He did not advise the use of the visual indicator until the centre of the beam had been reached and the machine headed towards the beacon, and again emphasised the value of the directional gyro.

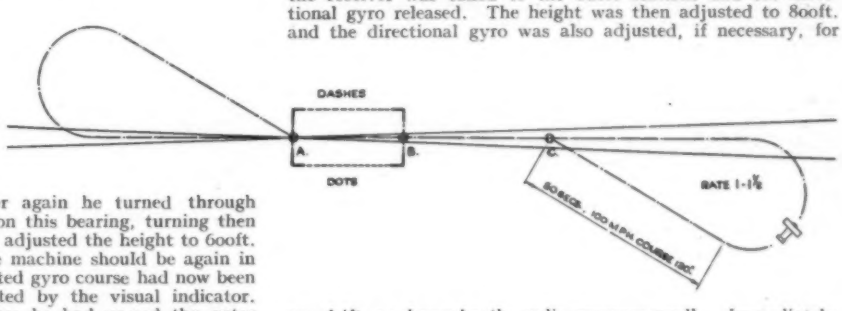
Preparation

During this period the machine was flying at about 2,000ft., but as soon as the outer signal was heard the height was lowered to 1,000ft. and any tendency to drift from the correct line was checked and allowance made for this drift on the directional gyro. On reaching the main beacon, which would be identified by a sharp signal cut-out when flying over it, the machine should be turned through 30 deg. and flown for 50 seconds, after which the turn should be made, at a rate of one or one-and-a-half on the turn indicator, through 210 deg. It would be noticed that in flying the reciprocal bearing the visual indicator worked in the opposite direction. Once again the inner mark of the signal would be heard and the pilot would be aware of his position.

The latest form of visual indicator, with the kicking directional needle at the base, the two Neon lamps on either side, and the much-criticised glide-path indicator above.



The approach method suggested by Sqn. Ldr. Blucke for use with the Lorenz system when no two-way radio assistance is available. (*Crown Copyright Reserved.*)



On reaching the outer marker again he turned through 30 deg. and flew for 50 seconds on this bearing, turning then through 210 at the same rate and adjusted the height to 600ft. At the end of this manœuvre the machine should be again in the centre of the beam. A corrected gyro course had now been flown with great accuracy, assisted by the visual indicator. In the case of the Monospar, once he had passed the outer marker beacon he wound back the tail trimmer to a marked position, throttled back to 2,200 r.p.m., and adjusted the speed to 80 m.p.h. and the rate of descent to 300ft. per minute. Height should not be lost below 100ft. until the signal from the inner marker had been heard.

When the sensitive altimeter registered 40ft. speed was adjusted to 65 m.p.h., the artificial horizon brought into the level-flying position and the r.p.m. increased to about 1,000 in order to check the rate of descent.

Before dealing with the second system, Sqn. Ldr. Blucke stressed a number of points, the first of which was that the directional gyro was a "master" instrument when the beam had been reached and that this should be checked very carefully so that alterations would not be necessary towards the end of the approach. It appeared that aural signals alone were best used while approaching the beam, but he added that the movement of the needle when off the beam gave some indication of its proximity. The Neon lamps provided a rather more accurate indication of the passing of the marker beacon since these only lit when the machine was passing directly overhead. These visual signals would not be seen above a height of about 1,000ft. In the case of the Monospar he noted that when flying away from the beacon a signal was very much weaker and this might be of help if by any chance the pilot first arrived on the wrong side of the main beacon. The note of the main beam was extremely steady and if there was any suspicion of dots or dashes the machine was certainly off course. There was a distinct "twilight" zone on each side of the equi-signal path.

The ground equipment for the Hegenberger system comprised two stations, each consisting of a medium-wave low-power transmitter giving all-round radiation and having a short-wave low-power transmitter capable of emitting a vertical sheet of radiation for use of marker beacons. Of the two stations, which were of different frequences, the inner gave a steady marker signal note, while the outer marker was keyed. Apart from the blind-flying instruments the machine carried a radio compass receiver with remote control; a marker beacon receiver; a radio compass indicator; a marker beacon indicator; a loop aerial and marker beacon aerial; and a distance or tuning indicator.

The first action of the pilot was to home on the inner beacon at a safe height, having previously ascertained the bearing of the approach line. On reaching this beacon he turned on to a course at 30 deg. to the approach line. This had to be done very smartly and immediately. He flew for 50 seconds on this course and then turned at the usual rate to the left until a turn of 210 deg. had been completed. Afterwards the radio compass needle should be in the centre, and if the turn had been made correctly the reciprocal bearings of the approach line would be shown on the gyro.

The radio compass needle, which would still be tuned on the inner beacon should now be used alone and the directional gyro set at 180 deg. and locked. When the inner marker reappeared, the receiver was tuned to the outer stations and the directional gyro released. The height was then adjusted to 800ft. and the directional gyro was also adjusted, if necessary, for any drift, as shown by the radio compass needle. Immediately the outer marker beacon light came up, he turned to 210 deg. on the directional gyro and flew for 50 seconds before turning again through 210 deg. The receiver remained tuned on the outer beacon. An endeavour should be made to reach 600ft. before the outer beacon came up again.

As soon as this outer marker appeared the receiver had to be retuned to the inner marker frequency and the radio compass needle centralised. The trimming wheel was moved to its marked position and the speed adjusted to 80 m.p.h. The rate of descent was again kept at 300ft. per minute. At this point the distance meter should be watched and the nearness of the inner beacon consequently gauged; a pilot soon learnt, by experience, the distances corresponding to the needle readings for a given transmitter. He did not advise reducing height below 200ft. until the meter indicated a very close approach. During the landing stage the process was similar to that used in the case of the Lorenz approach.

Comparisons

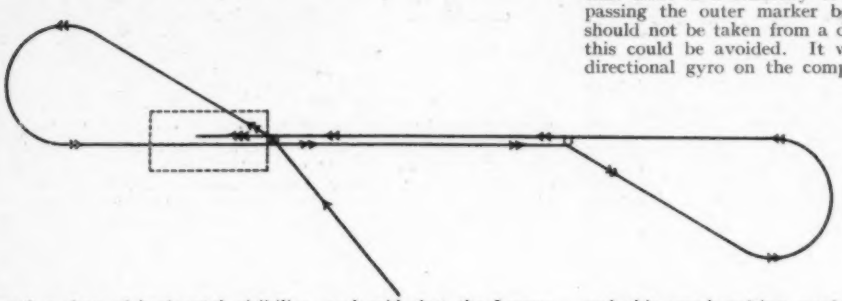
Sqn. Ldr. Blucke emphasised the need for smart turns when passing the beacon stations, and also the necessity for repetition of the whole process if a pilot had any doubt of his position or accuracy.

Summarising his impressions, he gave the following advantages for the Lorenz system: The beam was set on a geographical line over the earth's surface; audible warning was provided of any wandering from the correct course; there was no tuning anxiety since this was fixed; the signal was free from atmospheric interference; and the audible signal permitted concentrations on the other blind-flying instruments. In the

case of the Hegenberger system, he thought that the main advantages were that the pilot was immediately aware of the aircraft head in relation to the ground transmitter; that the radio compass indications were rather more natural; and that cross bearings for the initial homing could be taken from any station. He mentioned as disadvantages the fact that medium-wave had to be used and that there was a good deal of congestion on this in Europe; that the radio compass was rendered useless by interference and heavy atmospherics; and that the pilot had to tune the receiver frequently.

He thought that fog should be measured in terms of vertical rather than of horizontal visibility, and said that the Lorenz system could be used with safety in a fog ceiling of 100ft., provided that the altimeter was checked. He himself had made several landings with a cloud or fog ceiling at that height. The fact that the Lorenz system required little or no attention created a comforting sense of security under fog conditions. He suggested that, in a machine carrying two pilots, some other member of the crew could watch the ground while the chief pilot concentrated attention entirely on the instruments.

In his conclusion, Sqn. Ldr. Blucke stressed the importance of preliminary training and later practice and had a good word to say for the Link trainer. Aerodrome runways, he thought, should be at least 1,300 yards in length, the longer the better, and as level as possible. At a distance of 1,300 yards the equi-signal zone was 86 yards wide and therefore a runway width of 100 yards should be sufficient. There should be no obstruction greater than the minimum safe height over the inner marker beacon for at least half a mile before reaching this site. The reason for this allowance was that there is a tendency to lose height rather quickly after passing the outer marker beacon. The blind-approach line should not be taken from a due north or due south bearing if this could be avoided. It was necessary to synchronise the directional gyro on the compass during the actual approach, and this synchronising would almost be possible on a north or south course. He thought that the outer edges of the beam might be suitably illuminated for night approaches and that the aerodrome should be marked in the usual way with chalk lines or with sunk lights. The development of the three-wheeled undercarriage might solve the final landing problems, and he demanded some sort of ice protection in order that blind approaches might be made with the maximum of safety.



A diagram showing the three phases of an approach by the Hegenberger system, using two fixed or mobile omni-directional transmitters with auxiliary marker beacons. (*Crown Copyright Reserved.*)

THE DISCUSSION

ALTHOUGH Prof. Hill set five minutes as the absolute limit for any speechmaking, we cannot help feeling that the whole business of the discussion should be made a little less formal for the benefit of those members of the audience who are not particularly good at this form of amusement, but who, nevertheless, wish to ask some intelligent questions. The five-minute ruling certainly helped, however, to keep this discussion to the point.

Wing Cdr. H. de Burgh was first on the list of official discussers. He mentioned some of the difficulties of experimental work and gave full credit to Mr. Cox Walker, who, from the technical side, assisted with the work. He did not think very much of the vertical guidance provided in this Lorenz system since the habits of the indicator, he said, were not reliable. The vertical shape of the beam was distorted and ground objects effected this shape. He thought this shape might be improved by using horizontal aerials, but felt that until the indications could be entirely relied upon they could not be used.

As a director of the airport where the Lorenz system was first installed in this country, Mr. R. P. G. Denman's contribution was a valuable one. He pointed out that the two systems described by the lecturer were not in any way comparable and that the two systems had been thoroughly tested at Langley Field some four years ago. In those days the track beacon method was known as the Diamond and Dunmore system, and even then the vertical guidance part of the idea was considered to be extremely useful and full of possibilities. The track beacon system does at least provide *potential* blind landings, and in the matter of distortion T.W.A. in America had made tests and found that there was a slight raising of the beam in wet weather, but this was not serious.

Mr. C. E. G. Bailey, of R.T.E., suggested that the civil people should get in touch with Farnborough in order to compare figures for different machines. His own company's medium-wave track beacon was of the same nature as that at Schiphol, Amsterdam, and it had the advantage that "homings" might be carried out with the normal radio equipment. The marker beacons had their frequencies modulated, in order to be distinguished from the main beacon, but the wavelength was the same. Mr. Bailey, with the help of a gramophone, then gave an aural demonstration of the signals provided by his system.

Mr. L. A. Sweny, of Marconi's, said that in their experience the shape of the beam was certainly changed by differences in the ground's conductivity. He asked whether the approach methods needed to be so complicated and briefly described the methods used by transport pilots.

Capt. Dismore, of Imperials, spoke about the difficulties of holding a very large machine on the correct track in bumpy weather.

After alluding in a humorous manner to his experiences in America several years ago, Mr. F. S. Barton of the R.A.E. complimented those who had installed and tested the equipment at Farnborough. He thought the lecturer was a little hard on the Hegenberger system, and stressed the value of its mobility. He did not think that the tuning difficulty was serious, and mentioned a Siemens patent for lining on the beam with the aid, presumably, of an automatic pilot. Everybody, he thought, should support the aviation community in their demand for waveband extensions.

Mr. Nigel Norman thought that the lecturer had exaggerated the amount of obstruction-free area required and said that anyone with experience of site purchase would realise the difficulty. He stressed the importance of the time factor in transport operations, and said that when a number of other machines were also waiting for their turn to land the pilots must try to come straight in. He suggested that more than one outer beacon might be installed in order to simplify such an approach and to enable the pilot to correct any drift in good time. He also suggested the use of aerodrome threshold lighting and of two-way beams, and asked about the possibility of automatic landings.

A representative of British Airways, as an operating firm with plenty of blind approach experience, having been asked for by the chairman, Mr. A. Hitchcock, the company's chief radio engineer, was prevailed upon to say a few words. He pointed out that transport pilots' attitudes in this country had changed over from bias to enthusiasm for the system during the last year or so. None of the B.A. pilots would now leave the ground unless the receiving equipment was working perfectly. He described briefly the stop-watch methods used by his company's pilots.

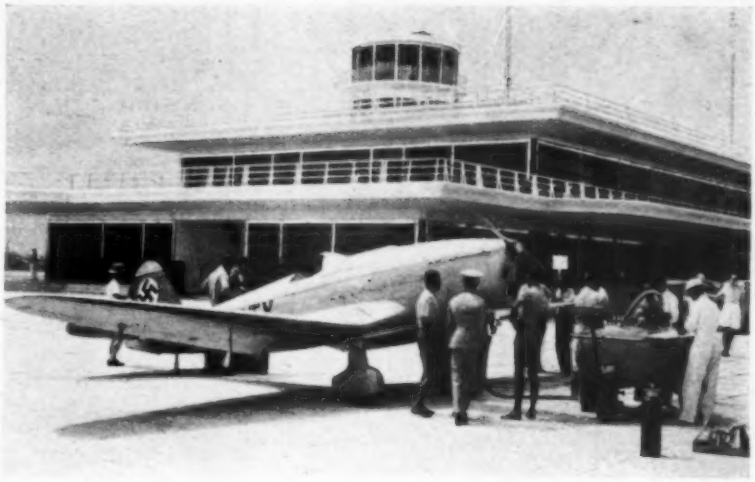
Sq. Ldr. Bonham Carter described some of the characteristics of more modern Service machines, and said that many of them had only just sufficient lateral stability and far too much directional stability. He also suggested that they were less manœuvrable at low speeds, and that, generally speaking, once the last phase of the approach had been started the pilot was more or less committed to a landing, which, however, was rather easier on modern types.

After Mr. W. O. Manning had asked whether any seaplane blind approaches had been done, Mr J. Furnival, of Marconi's, suggested that the track might be too wide, and asked what the lecturer thought was the ideal width. The Marconi system involved two overlapping beams, and their tests had suggested that a track width of forty yards was quite ample. He asked whether experiments had been made with the use of an automatic pilot in conjunction with blind approach receiver. Finally, Mr. W. E. Gray very sensibly suggested that the whole subject might be thrashed out in a rather more informal discussion.

Sq. Ldr. Blucke then replied briefly to the more important questions which had been raised. Referring to the glide-path indication, he said that they had made fifteen tests at Farnborough, and that the readings had never been the same twice. In his opinion the indicator might well be left off the instrument. He was in favour of the track-beacon system for a number of reasons. The fact that the Monospar carried no normal radio necessitated rather complicated manœuvres during the approach in order that the pilot might be quite sure of his position. The approach could certainly be simplified if D/F was available.

He had had no experience of big machines on blind approach experiments, but did not see why it should not be just as easy to keep any machine straight when flying by instruments, as when flying by normal methods. He stressed the importance of a constant speed and an accurate rate of turn during the manœuvres, and liked the idea of an extra marker beacon. His obstructionless suggestion was merely made as an ultimate aim. As for aerodrome illuminations, he was not in favour of them, as he thought that it was essential for success that the pilot should concentrate solely on the instruments and signals until the last possible moment. He thought that 4 deg. was the ideal width of beam, and did not like it to be narrower, particularly as the present directional gyros were marked in 5 deg. intervals. He was in favour of the use of back radiation.

PRIVATE FLYING



FAR EASTERN TERMINAL: A Klemm 35 being refuelled at Singapore's new land-sea airport. Major Haerle, the pilot, was on his way from Berlin to Batavia.

Topics of the Day

Blissful

AT the grave risk of being accused of priggishness, I must say that the abysmal, if perhaps blissful, ignorance of some of the alleged-to-be experts in matters concerning modern technical development is sometimes quite staggering. Nowadays, of course, there is a strong tendency for people to specialise entirely in one subject or another, and this specialisation appears to leave their brains completely unreceptive where other subjects are concerned.

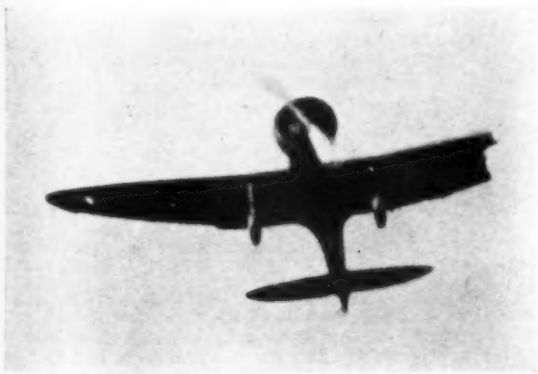
The discussions following the different Royal Aeronautical Society lectures occasionally bring this matter into high relief. One hears questions being asked about all kinds of developments which are very closely connected with the questioner's own line of business—questions which they would not have needed to ask if they had taken the trouble to read and digest articles published perhaps two or three years ago in the technical papers. If they had even gone out and had a word or two with their fellow-conspirators—or, in other cases, with one or two modern-minded transport pilots—their remarks might at least have been couched in rather less idiotically innocent phrases.

The need for specialisation is obvious, but it becomes extremely uneconomical in time and money if it is carried to its logical conclusion. At present we occasionally have people designing aeroplanes and equipment without even asking the pilots or the operating companies who are to use them whether this or that is actually a practical layout.

Pilots themselves are largely at fault because they can rarely be persuaded to get up and to say exactly what they *do* want. Some of our very best transport pilots will admit that, once they have parked their machines at the respective terminal airport, nothing would induce them to take any interest in any subject connected with flying.

Consequently, we had, until a year or so ago, the interesting spectacle of a group of flying experts who knew nothing, cared less ("don't like the idea, anyhow") about such matters as blind-approach and kindred systems, while their brethren on the Continent were finding out everything they possibly could about the different systems—and practising what they preached. Conversations with Swiss and German pilots two years or more ago provided me with as much solid information (sometimes a little garbled because of its "second-handness") as that given by the lecturer and the persons who joined in the discussion at last Thursday's lecture.

However, we muddle through—and are proud of reaching our ends by this strangely inefficient method.



NIGHTMARE: Most of us have occasionally gazed pensively at a wing tip and wondered horribly what we should feel like if it suddenly disappeared. This Japanese fighter (apparently a Mitsubishi Karigane) was brought safely back to its base with half of its port wing shot away. The photograph appears to be quite unfaked and the starboard aileron can, in the original, be seen to be pulled right up to hold the machine level in this condition.

Medical

I DON'T know whether there is anything in the high altitude cold cure business; possibly there is. What is far more important is the psychological effect of flying as such, which gives the ordinary mortal a magnificently false sense of importance in a world in which he is normally trodden beneath the mud by his fellow-men and buffeted helplessly by the forces of Nature. The pilot, however inexpert, obtains a special sense of power from his ability to control his quaint outfit in the face of what appear to be impossible difficulties and dangers.

Not long ago I met a non-pilot who had just been allowed to take over and to land a specially fool-proofed machine. His enthusiasm was terrific and his pride in his own achievement almost beyond words. Whatever ailments he may have suffered from the day before were completely dissipated. He was a birdman, and he had lived for a few short moments with the gods.

Some ingenious practitioner might start to recommend a course of flying for patients whose troubles are largely or entirely of their own imagining. The more concentrated effort of learning to fly would at least prevent such people from brooding too heavily and continuously on their other troubles. An hour of really fearful landing practice, with an instructor who did not mince his words, would, too, deflate those more unpleasantly self-important persons.

Navigational

A FEW days ago I played for a few minutes with a navigational gadget which I had not previously seen in real life, though I had seen it illustrated in American books on transport navigation. This device, known as the Dalton Computer, is now used by all Imperial Airways' pilots, and it appears to perform all the tricks which any pilot could possibly ask of it.

Probably it is necessary to spend an hour or two with

(Concluded near foot of next page.)

Private Flying

FROM the CLUBS and SCHOOLS

LONDON

FLYING time for last week was 48 hr. 25 min. and among the new members were Messrs. A. R. West and J. B. Mills.

MARSHALL'S

Such high winds as were evident on Wednesday, Saturday and Sunday were the cause of the low flying total, which was 20 hr. 25 min.

C.A.S.C.

The Corp's fourth annual dance will be held on Thursday, February 17, at the First Avenue Restaurant, Holborn, W.C.1. Owing to extremely high winds no flying was possible at Cambridge last week-end.

NEWCASTLE

The £25 Scholarship Scheme is going ahead rapidly and several new pupils have started instruction. Although the flying weather has been very indifferent a total of 10 hr. 55 min. flying was put in by members.

HAMPSHIRE

An Impersonation Party is to be held in the clubhouse on Saturday, January 22, 1938. Flying for the fortnight ended January 14 was logged at 50 hr. 10 min. Mr. E. P. Swallow is a new pupil with "B" licence intentions.

YORKSHIRE

The dance in the clubhouse on Saturday, January 8, proved a great success and another one is to be held shortly. January has already produced 28 hours' flying, which was the total for the whole of January last year.

BOMBAY

During the month of December a total of 223 hr. 20 min.'s flying included 1 hr. 50 min.'s night flying. Mr. D. A. Samant has been concentrating on night cross-country flying from Bhavnagar. Flights were made to Poona, Rajkot, and Bhavnagar. Messrs. C. B. Rodgers and P. D. Byramji obtained their India "B" commercial pilot's licences. The membership of the club now totals 560, and during 1937 a total of 2,670 hr. 55 min. flying was recorded and this exceptionally good total was entirely free from accidents.

HANWORTH

The annual general meeting of the club took place at the Hanworth Park Hotel on January 12 and a general purposes committee was appointed with Mr. J. Rush as chairman, Mrs. Jill Wyndham, Sir Charles Wrench, Messrs. R. C. Jude, Welsh, Henry, A. H. Swann and J. Brady as members, and a flying committee with Mr. James Rush as chairman and Messrs. J. Brady, R. C. Jude and T. V. Welsh. A club dance will be held at the Hanworth Park Hotel on February 11. A cabaret show and running buffet will be among the attractions, whilst visiting machines will be housed free of charge. A further Aeronca will shortly be available at the school. Several cross-country trips were made, including one to Shoreham and another to Gatwick, and a total of 35 hr. 20 min. was spent in the air.

HERTS AND ESSEX

One hundred hours fifty-nine minutes were recorded for the fortnight ended January 13, although bad weather stopped flying on two days. A tramps' party is being arranged for Thursday, February 3, to be held in the clubhouse.

DONCASTER

The bad weather of December has continued into January and has been chiefly responsible for limiting flying time to a little over 5 hours. A small but steady flow of members continue to join. The clubhouse has been redecorated throughout and is rather attractive.

NORWICH

Whilst compiling the Air Ministry returns for 1937 it appeared that 1,515 hours' flying had been put in, showing an increase of 50 hours over the previous year. Thirty-one pilots were trained and, of these, thirteen were members of the Public School Aviation Camp. The fleet now consists of four Gipsy I Moths and a Hornet Moth, having been increased by the purchase of a Moth. Further developments were the new tennis court and the gliding section which is run by a special committee under the chairmanship of Mr. A. R. Colman.

SOUTH COAST

A review of the year 1937 by Capt. Davis at the New Year dinner revealed that a large increase in membership was apparent, there now being 320 members, while flying for the year totalled 1,500 hours. An even more interesting programme is being arranged for 1938 and Mr. White and several members have offered to present trophies. A dawn patrol, even bigger and better than the last, is being considered for the Spring, when the South Coast Flying Club intend to eat all the breakfasts themselves. The annual general meeting was held on Saturday and the committee for the ensuing year was elected. Flying activities have been somewhat held up by the bad weather, but a series of lectures, up to the standard of Ground Engineer's "A" and "C" licences by the chief ground engineer, have been designed so that time might be profitably used.

BROOKLANDS

The humbler games of Peggety, draughts and table tennis took the place of flying over a wet and windy week-end. While the rain fell outside, it was possible to go further into the discussion of the handicap series of club competitions and it has been decided that the Ted Jones challenge cup, which was given by the late Mr. Jones for the best performance by any member in any one year, will be held for the year by the member who aggregates the highest marks—as was mentioned last week. In addition, the Doncaster Trophy, which Brooklands' team won outright a few years ago, is to be used for an inter-club competition between teams from Brooklands, Lympne, Shoreham and Northampton. This will probably be an annual event, and the competition will be held in July. The annual general meeting of the Brooklands Flying Club will take place on Saturday evening, January 22, to be followed by a dinner and dance.

Topics of the Day

(*Continued from page* 61.)

it in practice work, but the expert user can produce the most amazing results with one hand once he has become accustomed to its operation, and I am looking forward to the chance of using one of them for a few weeks.

Although practically all our minor problems can, in fact, be worked out by the intelligent use of a plain proportional calculator, some of us derive special, if misguided, pleasure from the operation of very complicated devices. Though quite why it should be fun to work out accurate E.T.A.'s in perfectly good weather conditions, or to work out the approximate air temperature at operating height, is beyond me.

INDICATOR.

Perth's Aero Ball

THE second annual ball of the Strathtay Aero Club was held in Perth last Friday. Something like 200 members and guests turned up—coming from Angus, Perthshire, Dundee, Glasgow and Edinburgh. A feature of the entertainment was a midnight cabaret, the artists being members of the local pantomime. The Earl of Airlie, a member of the club, was patron of the function.

Cheshire Centre

SINCE the Liverpool and District Club transferred the majority of its activities to Speke, not a very great deal has been heard of the long-established aerodrome at Hooton on the Cheshire side. This is now known as the Merseyside Air Park and it is expected that the landing area, which already provides a prevailing wind run of 1,300 yards and a minimum run of 800 yards in every direction, will shortly be extended to provide minimum runs of 1,000 yards in every direction, thus bringing the area within the maximum requirements laid down by the Maybury Committee.

Apart from Service flying by one of the auxiliary squadrons —No. 610 (County of Chester)—Utility Airways carry out charter and taxi work from their base at Hooton and the Liverpool Club still provides facilities on the Cheshire side of the water. Additionally, quite a number of other companies have depots there and facilities are provided for such sports as indoor tennis, squash and riding.

The estate is controlled by Mr. and Mrs. Frank Davison, who also control both the Utility Airways and Altigraph, Ltd., and are both experienced pilots.

Cropped Airscrews in England

IT appears that Mr. A. J. Walter, the Taylor Cub distributor in this country, has obtained the agency for the Everts single-blade airscrew. Examples for use with low-powered engines are already over here and Mr. Walter expects to be able to import a version suitable for a 1,000 h.p. engine in the near future.

The idea behind this single-blade airscrew idea is, of course, one of obtaining maximum efficiency. The inventor found that the air stream was smoothed out practically to the normal flow during one revolution of a blade, whereas a second or third blade was working in disturbed and inefficient air at normal cruising speeds. Apparently the Cub, for instance, has its cruising speed increased by something like ten miles an hour. Needless to say, the single blade is counter-weighted and the only adverse effect on the aeroplane to which it is fitted is in its appearance. This is, to say the least of it, quaint.

Recently, by the way, the American Taylor Aircraft Co.'s name was changed to the Piper Aircraft Corporation and a new model has been announced as a companion to the familiar "Trainer." This will be known as Cub "Sport." Mr. Walter's address is 37, Lancaster Close, St. Petersburg Place, London, W.1, or Hanworth Air Park.

COMMERCIAL AVIATION

THE FASTEST TRANSPORT: A revealing view of the Savoia Marchetti S.83 as ordered by Sabena and by transport concerns in Italy and Rumania. Powered with three Pegasus-type Alfas, the top speed, with a disposable load of 7,700 lb., is 263 m.p.h., making it the fastest standard transport in the world. The type is derived from the S.79 which holds a number of records for speed with load.

THE WEEK AT CROYDON

Political Backsliders : Falling Bodies : Imaginary Improvements : Inevitable Agreement : Monopolistic : Another Hazard

MR. ANTHONY EDEN might just as well have crossed from Paris by air during Saturday's gale, for it is always safer and better to deal with the vagaries of one element at a time. The rumour that, when he cancelled, somebody presented him with an ancestral but bladeless bayonet is not confirmed, but, anyway, from what I hear of the tribulations of Channel shipping on Saturday, a collapsible lifeboat and a couple of spare lifebelts would have been a more seasonable gift.

Most air services operated as usual that day, whereas Mr. Eden's vessel, after emulating a bucking broncho all the way across, crashed into Folkestone pier, straining its plates and denting its bows. It then cannoned off the jetty and narrowly missed crashing into another ship. It all seems so time-wasting and primitive in comparison with a good aeroplane.

Then there was Mr. de Valera, who might have added lustre to his name by flying over from Dublin on Saturday with the Irish Sea Airways machine which ran before the wind and beat all previous records for the trip, with a flying time of 86 minutes, as against a previous best effort of 97 minutes. Maybe these politicians prefer the enthusiasm at Euston, the vociferations at Victoria, the pandemonium at Paddington, or even the loud laughter at Liverpool Street, to the matter-of-fact way in which they are received at Croydon. Certainly anyone who deliberately chooses the horrors of a sea crossing deserves the plaudits of a railway station mob.

Air Devastation Board

So far as one can see, it is difficult on Saturday mornings for the men working around here on the scaffolding to get back from their leisurely elevenses in time to knock off work for the day. Perhaps or perhaps not—without having what is called cast-iron proof I don't want to lay any blame unjustly—some such haste may have been connected with the fact that some time afterwards certain enormous and heavy planks descended one by one, shaking the very earth as they did so, on the spot where Imperial Airways coaches often pick up passengers. Nobody's brains were dashed out, as it happens, so why worry?

Swissair are experiencing bumper traffic on the Zurich route at a time when other services are not doing so well as might be expected. I hear they are fully booked up for ten days ahead and contemplate duplicating services, and, moreover, the mails carried outwards from here on that line weigh well over 1,000 lb. a day. Incidentally, it was the Swiss company which brought in Dr. Mengelberg, the famous Dutch musician, who will appear at the B.B.C. symphony concerts. He was met by members of the B.B.C.—looking extremely B.N.C., I thought.

With pathetic optimism some news agency has sent a cameraman down here to obtain first pictures of the alleged improvements to the place. These, according to the poor bloke himself, are said to consist of a tunnel under Purley Way to contain a (presumably) bomb-proof barber's shop. This tunnel may be driven at any moment, apparently, and there is another sudden scheme, which is to deflect Purley Way itself so that it will face in another direction, doubtless to complete the confusion of the airport road traffic. The cameraman believes these things will happen when he is not looking, if he is not devilish alert, and, in consequence, he follows anyone with a spade or mattock. Works and Bricks report that they are "fair wore out along of being followed about and having their pictures took," and there the matter rests at present.

So rest also certain odd jobs about the place, such as the torn and mangled iron railings near the entrance gates, and sundry holes in the roof of the main hall.

Playing Trains

Railway Air Services, together with certain subsidiary or affiliated companies, had a jolly day last week when they met to decide time-tables, the distribution of traffic, inter-availability of tickets, and so forth, on their own network of air lines. Though the affiliated companies are said to retain independence, I visualise the meeting as rather like a free and independent parliament in a dictator-obsessed (I did *not* say oppressed) country. No doubt the chairman was an impressive figure in his top-hat made from a railway engine chimney, with fumes coming out of the lidless top. The "ayes" would undoubtedly have it, unless the answer required was in the negative. Sunday newspapers seemed to have the idea that the whole future of internal flying was settled at this meeting, and one broadsheet spoke of the joy the Maybury Committee would feel about the whole show, especially the "elimination of

wasteful competition," which blokes like you and I call throttling the life out of the small independent man.

What with one thing and another in general, and Mr. Perkins in particular, I think the day of that sort of oppression has gone. Only the other day that "Hindenburg line," the Railway Clearing House, collapsed in sudden panic, and an independent firm, North-Eastern Airways, walked through the derelict defences unopposed.

It is as clear as daylight that the railway monopoly of air lines will be bad, for railways are their main concern, and air lines, properly run by people in competition, will eventually show up the railways in quite a number of ways. Naturally, this will never be done by the railways themselves, who, according to a ribald friend of mine, are looking for a commercial machine to fly slower than their star expresses.

Various companies and their pilots are still very bitter about the unnecessary hazard caused by the new steel lattice tower on top of the hill to the south of the landing area. One must, however, be fair to those responsible for its erection Maybe this is an atavistic return to the eighteenth-century craving to build silly towers, known as "follies," on hill-tops; these seldom serving any purpose at all except when used to guide smugglers, or (perhaps a more parallel case) to lure ships on to the rocks for subsequent plundering.

But more probably it is the result of a Meccano-starved childhood full of frustrated cravings for the long whippy pieces with which you build tall lattice-work towers. Many a grown man, after all, plays trains all day in a suitably upholstered room and watched by a friendly warder. Would not the same man, given endless funds and his freedom, play with real trains up and down our main lines, all unconscious of the danger?

"Blimey, how they trust us," remarked someone, seeing the newly erected show-cases in the main hall, which contain full bottles of a well-known brand of gin. But do they?

Look at the backs of the bottles and you will see a whole sermon on the fallibility of human nature—the word "dummy."

A. VIATOR.

Trans-Canadian

IT is now expected that the section of the trans-Canada air service between Montreal and Winnipeg will be opened on February 1 and that the whole section between Montreal and Vancouver will be in operation by the middle of the year. The entire fleet of Lockheed 10s and 14s should be delivered before the end of 1938.

Milan's Combined Airport

TOWARDS the end of last year the recently completed civil land-water airport at Linate, Milan, was officially opened. The aerodrome is approximately rectangular in shape with a maximum run of about 2,000 metres, and the marine alighting area adjoins its east side. This latter is of an artificial nature and has the same maximum run as that of the airport, but is only 400 metres wide. The new airport has been named after Enrico Forlanini, the Milanese dirigible constructor. General Valle, the Under-Secretary of State for Air, assisted in the opening ceremony.

One Up for the Landing Stick

A SPARTAN Cruiser on the Northern and Scottish Renfrew-Campbeltown run was forced to turn back owing to bad weather. There is no radio at Campbeltown and after recrossing the Renfrewshire coast the pilot, Mr. F. P. J. M'Gevor, flying blind, suddenly felt the weight of his trailing aerial bounce on some obstruction. Pulling back his control column he opened up wide and lifted the nose of the machine. A second later, however, he felt it hit the ground. Thirty yards farther on the machine swung to a standstill, minus its undercarriage. He and his operator were unhurt and used the detached compass to find their way to Largs.

The accident occurred a few minutes after six o'clock last Friday and it is presumed that the remains lie on the Hill of Stake, which rises to over 1,700ft. and is nearly five miles from Largs. Now what about the landing stick idea? Apparently the previously corrected altimeter reading was 2,200ft. at the time of the crash.

Internal Co-ordination

FOLLOWING the conferences which were held, and the inter-company arrangements which were made, during last summer, Railway Air Services, who now may be said to control the greater part of the internal airline network, recently held a full conference in London with five of their co-operating companies—Jersey Airways, Guernsey Airways, Isle of Man Air Services, Northern and Scottish Airways and Highland Airways.

Among the practical results which may be expected are extensive through booking facilities over the length and breadth of the country; the planning of circular tours by different means of transport; the issue of a comprehensive time-table covering the entire network; and the co-ordination of luggage, tickets and similar arrangements. It will be remembered that an independent company, North-Eastern Airways, still handles the East Coast traffic with a service between London, Newcastle and Perth in the winter and including Aberdeen in the summer, while other concerns which are doing useful work, such as Western Airways and Allied Airways, still remain outside the "iron ring."

Unsurcharged to Malaya

THE twenty-third of this month is the date on which the unsurcharged carriage of all first-class mails between Great Britain, India and Malay will be started. This marks the second stage in the scheme for the carrying of all such Empire mails by air. The third stage, which will include Australia, should begin in the early summer.

The Short *Centaurus*, which is now on its return survey flight from New Zealand, reached Melbourne on January 13 after a four-hour flight from Sydney.

Transport Comparisons

A SMALL error, which did not affect the arguments put forward, appeared in the table accompanying last week's remarks on Transport Comparisons made by a reader in reply to Mr. Luard's article of the previous week. The "Capital Cost time/mile load per hour" figure for the D.H. Rapide should have been £29 10s. 0d. and not £39 10s. 0d. For once in a way this was a genuine version of "printer's error" so beloved of sub-editors.

The Pacific Disaster

ALMOST immediately following an accident to a North-Western Airline's Lockheed 14 flying between Seattle and Chicago, the loss of the Pan-American Airways boat *Samoan Clipper* must have been a serious blow not only to American air transport interests, but also to the American public. Capt. Edwin Musick, who had probably had more experience of long-distance oceanic flying than any other transport pilot in the world, was in command and his life, apart from those of the other six members of the crew, was one hardly to be spared.

The machine, a Sikorsky S42B, was on the last stage of its first official flight on the San Francisco to New Zealand service when the accident occurred. The wreckage was sighted by the U.S. aircraft tender *Avocet* which had been searching in the district of Pago Pago. In his last message Capt. Musick reported an oil leak from one of the four motors and said that he was dumping some of his heavy load of petrol before attempting a landing. Apparently this fuel caught fire as it was pouring out of the valves and the machine was almost completely destroyed; the fact, among others, that the floating wreckage consisted of only the lighter sections of the machine suggests the fire actually took the form of an explosion, and there is little doubt that all the members of the crew were killed instantly. The necessity for dumping is obvious when it is remembered that the *Samoan Clipper* was carrying sufficient fuel for a flight of more than 3,000 miles, and a landing with such a load on board would obviously have been almost impossible. The accident must have occurred at about 8.30 p.m. G.M.T. on January 11.

Not very long ago the U.S. Bureau of Air Commerce recognised the danger of fire in such circumstances and ordered the sealing of all dump valves in passenger-carrying machines. The Sikorsky, however, carried a special licence for an experimental series of flights and fuel had, in fact, been dumped quite satisfactorily during test flights. The possibility of a static discharge cannot be overlooked in examining the possible reasons for disaster.

Capt. Edwin Musick had had twenty-four years of flying experience and had probably surveyed every Pan-American air route, other than those over the North Atlantic, since the company's inception.

AIRPORTS of TO-DAY

Six of the Most Recently Completed or Partially Completed Airport Layouts Described : Planning for the Future

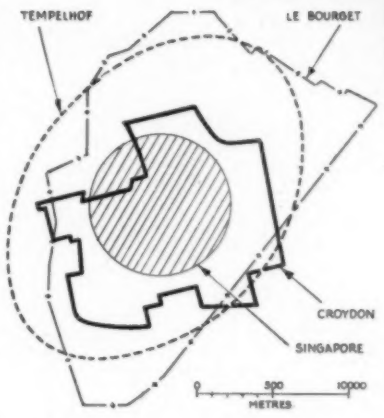
ACHIEVEMENT is always more interesting and instructive than mere projection, and in the following pages we are describing a number of airports or airport buildings which have been either started or actually finished during the past year. In each case totally different architectural and other ideas are brought into actuality, and in one case, that of the projected Empire air base, these ideas have still to be put into action.

Perhaps the most interesting common feature is the way in which the plans have been laid very thoroughly for an expected future. The most remarkable project of them all is that of Berlin, where the work involved is on a truly monumental scale and should be something of an example to the rest of the world and to ourselves in particular. In another case, that of Le Bourget, the best has been made of available material, and both the extended landing area and the new terminal building should be more than adequate for the next two decades.

Newfoundland's airport is of particular interest both because of its position and future use, and, from a more detailed point of view, because the lighting system is a reversion, with modern equipment, to the old and extremely satisfactory method of the flare-path. The same system, or a modification of it, will be used at the new Lydda airport in Palestine, which is described at some length largely because it is an important example of planning for special circumstances

Needless to say, it has not been possible to describe every new or projected airport, but the examples given are representative and should give an idea of the way in which the work of ground organisation is going ahead all over the world.

As far as this country is concerned, two or three very important sites are being developed, notably at Elmdon (Birmingham) and at Ringway (Manchester), while it seems at least possible that the City of London will start work on its own airport at Fairlop during this year.



The superimposed diagrams on the left provide an instructive visual indication of the respective sizes and shapes of four of the more important world's airports. The shapes cannot show the details of the surroundings, and a very large area might well be spoiled by unhealthy obstructions. That at Singapore, for instance, may appear small in comparison with the others, but, the approaches are exceptionally good. The decoration above is a photograph of the control tower of Le Bourget's new terminal.

Worldport: Designed by Norman and Dawbarn for Shell-Mex, this model shows how a land-sea airport might be laid out to-day for maximum convenience and efficiency. A number of comparatively new and interesting features are included in the design, which might well be studied by anyone who is planning such an air centre

Airports of To-day

THE EMPIRE BASE

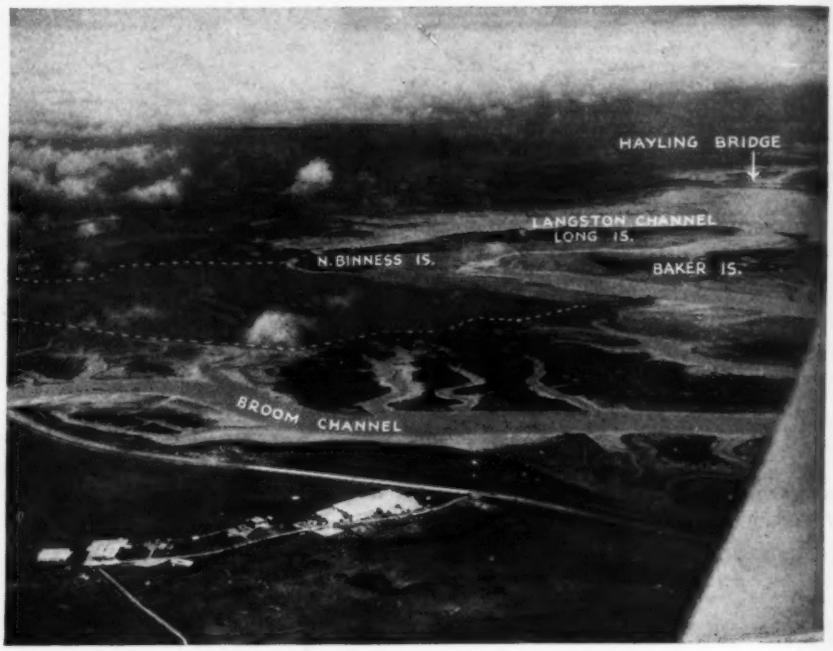
IF we forget the various political and other difficulties concerned with the long-discussed Langstone Harbour air base project, this scheme is one of the most interesting which has ever been put forward in this country. For the present the base at Hythe, with the use of Southampton Water, is proving quite satisfactory and it may be that Southampton will eventually be the Empire Air Base, but it is obvious that whatever plan is finally decided upon special and expensive arrangements will have to be made if more special and still more expensive arrangements are not to be found necessary in the course of a year or two. In other words, it is especially necessary in this case to plan for the future on a really big scale.

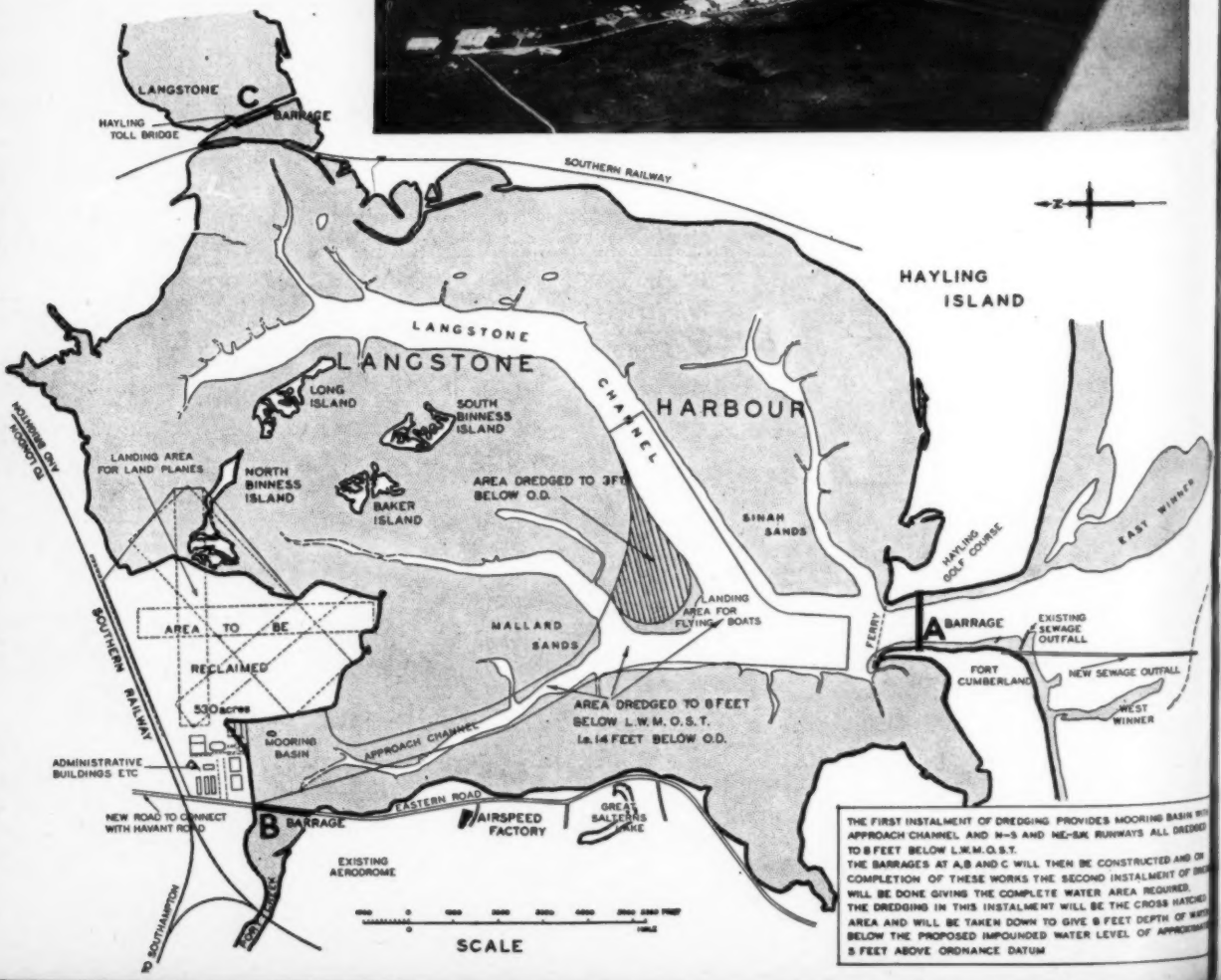
Some two years ago—actually in *Flight* of April 16, 1936, a date which gives an idea of the time during which the negotiations have been in progress—we published several photographs which were taken by our chief photographer over Langstone Harbour, and one of these is reproduced on this page to accompany the plan which represents the final scheme for the barrage system originally proposed.

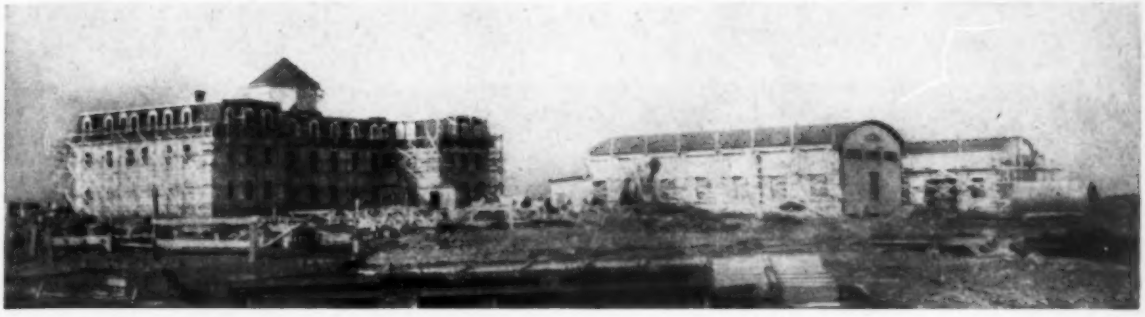
The plan, with the information given thereon, should be largely self-explanatory and it is interesting to see what a comparatively small amount of dredging will be necessary. The major part of the work, it would seem, will be involved in the reclamation of the area, seen on the left, for the development of the new aerodrome.

Although it is a pity, perhaps, that Portsmouth's beautifully-surfaced and entirely adequate present airport should need to be sold, the position of the projected landplane airport is certainly a great deal more suitable when the entire plan is considered as a whole. The flying-boats will be able to moor directly alongside this airport, which, at the same time, adjoins the main line of the Southern Railway, on which a station will undoubtedly be built when the plan materialises. Apart from the South Downs, the approaches to this airport should be admirable.

The question at present seems to be whether a barrage or a tidal system of development will be used. There seems to be little doubt that, one way or another, the plan will eventually reach fruition.




LANGSTONE
HAYLING TOLL BRIDGE
C BARRAGE
SOUTHERN RAILWAY
HAYLING ISLAND
LANGSTONE HARBOUR
LANGSTONE CHANNEL
LONG ISLAND
SOUTH BINNESS ISLAND
NORTH BINNESS ISLAND
BAKER ISLAND
LANDING AREA FOR LAND PLANES
AREA DREDGED TO 3FT BELOW O.D.
SINAH SANDS
HAYLING GOLF COURSE
EAST WINNER
MALLARD SANDS
LANDING AREA FOR FLYING BOATS
A BARRAGE
EXISTING SEWAGE OUTFALL
FORT CUMBERLAND
NEW SEWAGE OUTFALL
WEST WINNER
AREA TO BE RECLAIMED
530 acres
AREA DREDGED TO 8 FEET BELOW L.W.M.O.S.T. i.e. 14 FEET BELOW O.D.
MOORING BASIN
APPROACH CHANNEL
ADMINISTRATIVE BUILDINGS ETC
NEW ROAD TO CONNECT WITH HAVANT ROAD
EASTERN ROAD
B BARRAGE
AIRSPEED FACTORY
GREAT SALTERNS LAKE
EXISTING AERODROME
TO SOUTHAMPTON
SCALE
THE FIRST INSTALMENT OF DREDGING PROVIDES MOORING BASIN WITH APPROACH CHANNEL AND N-S AND NE-SW RUNWAYS ALL DREDGED TO 8 FEET BELOW L.W.M.O.S.T.
THE BARRAGES AT A, B AND C WILL THEN BE CONSTRUCTED AND ON COMPLETION OF THESE WORKS THE SECOND INSTALMENT OF DREDGING WILL BE DONE GIVING THE COMPLETE WATER AREA REQUIRED.
THE DREDGING IN THIS INSTALMENT WILL BE THE CROSS HATCHED AREA AND WILL BE TAKEN DOWN TO GIVE 8 FEET DEPTH OF WATER BELOW THE PROPOSED IMPOUNDED WATER LEVEL OF APPROXIMATELY 5 FEET ABOVE ORDNANCE DATUM



NORTH ATLANTIC AIRPORT I

THE new transatlantic airport in Newfoundland lies 213 miles from St. John's (the capital city) on the main railway. It is approximately 400ft. above sea level and is built on a level plateau with no obstructions of any kind in the vicinity. Gander Lake is 1½ miles to the south. The site was covered with young trees when clearing operations began in 1936. The total cleared area is 770 acres, while the runway area is 254 acres—the equivalent of 100 miles of 20ft. road. The airport is in the fog-free zone, and the only possibility of bad visibility will be that caused by low cloud.

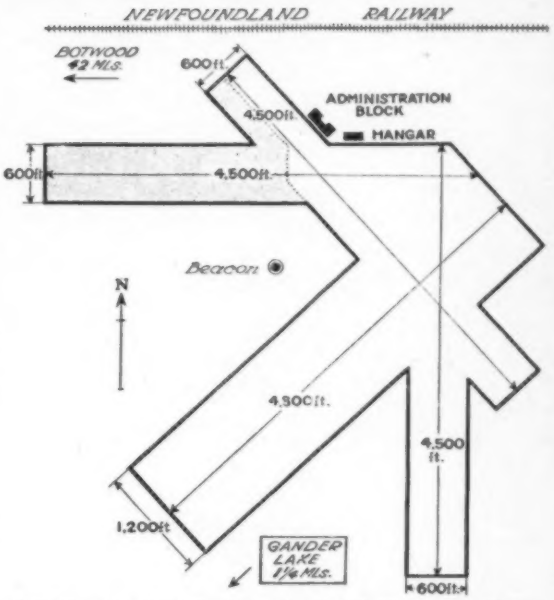
There are four runways, each intersecting at an angle of 45 degrees, so that no take-off or landing need be made more than 22 degrees out of wind. These runways will be surfaced with a 4in. deep paving of Colas and crushed stone and will be able to withstand a landing shock of 5 tons per sq. ft.

A wooden structure, the administration building is three stories high with a control tower on the roof; it is now nearing completion and is intended to house the staff, besides providing the office space for meteorological, wireless and control departments, Customs and so forth.

Illumination

Lighting arrangements, as already described in *Flight*, have been carefully studied. In place of the usual floodlight, "surface contact" lights are set in each runway at intervals of 50ft. down the centre-line. These lights project about two inches above the surface and cast a horizontal beam, thus doing away with the dazzle difficulty. Each runway is outlined by orange-coloured boundary lights placed at intervals of 200ft. These lights are six feet high, permitting the pilot more easily to judge his height for the touch-down, and those at the end of each runway are green in colour. The boundary lights are of the contact-breaking "tip over" kind to prevent damage in the case of collision, and the airport will also have a neon marker beacon mounted on a 14ft. tower, the location of which is shown on the sketch.

The radio receiving station will be located two miles west of the airport and the transmitter two miles east, both on a line roughly at right angles to the main, or No. 3 runway. This spacing gives a minimum of interference. At each end of the blind-landing runway there are two suitably spaced marker beacons for approaches from either direction. Installation of the D/F equipment is now proceeding and should be completed in time for the crossings in the late spring or early summer. The control, meteorological and wireless organisation for Atlantic flights will be centred at the airport.



The layout of the runways at the Newfoundland Airport, with a photograph of the buildings as they appear at present. The part of the runway system which has so far been completed is shaded. The whole system, with the hangars, should be ready in time for this summer's transatlantic experiments.

NORTH ATLANTIC AIRPORT II

ALTHOUGH the airport itself has still to be completed, Baltimore has, since November 14 last year, been used as the American flying-boat terminal for the Bermuda air service which is being run jointly by P.A.A. and Imperial Airways with a Sikorsky S42B and a Short Empire Boat respectively. The new airport, which directly adjoins the Patapsco River flying boat alighting area, and has a ramp, landing pier and maintenance shops beside the prospective landing area, has been reclaimed from the harbour and will have an area of some 360 acres when it is completed during this year. There will actually be four separate runways, each approximately 1,400 yards long, and the main buildings will be located on the north-east boundary.

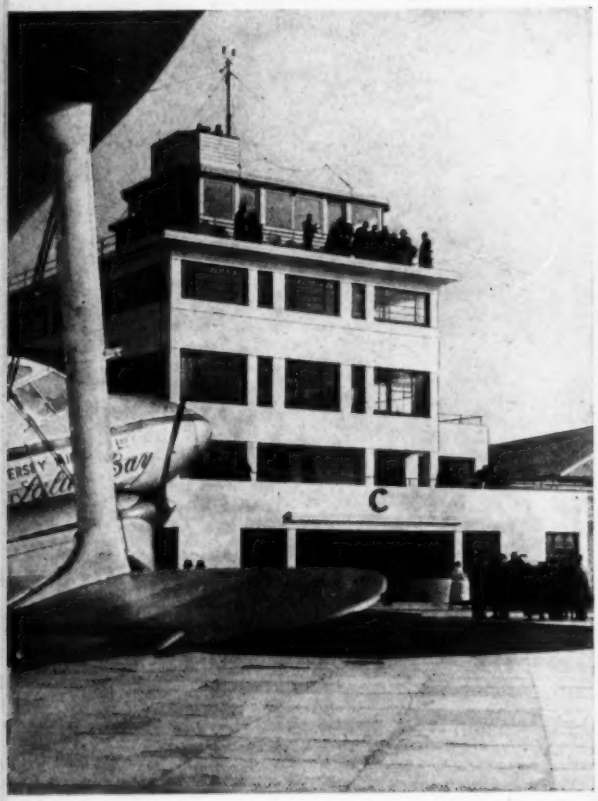
For flying boat work the estuary should be ideal, since there is very little traffic congestion; larger ships do not, in fact, use the area immediately beside the airport, but must necessarily stay in a specially dredged channel

(*Continued after double centre page.*)

The Short *Cavalier*, used on the Bermuda service, flies over the mooring area at the new Baltimore airport, part of which may be seen on the right.

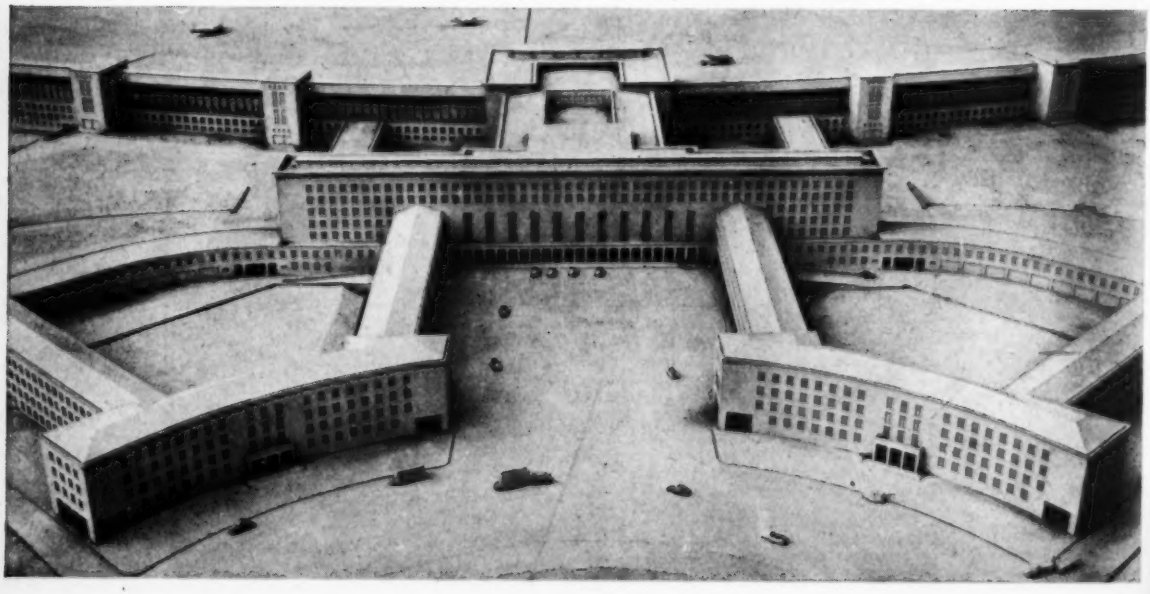
SOME of the

The Various Ways in Which Architects have A
Airports for Different Purposes and



Opened early last year, the Jersey airport terminal building is a good example of rational planning for a medium-sized airport. The *Flight* photograph above was taken immediately before the official ceremony.

In the centre and below are terminal buildings at Paris and Berlin, designed to accommodate the amount of traffic which may be expected during the next few decades. The new Le Bourget building (right) has already been opened and the aerial view was actually taken during the ceremony. The massive Tempelhof building, shown below in model form, is already partly in use and will be completed during the coming summer.



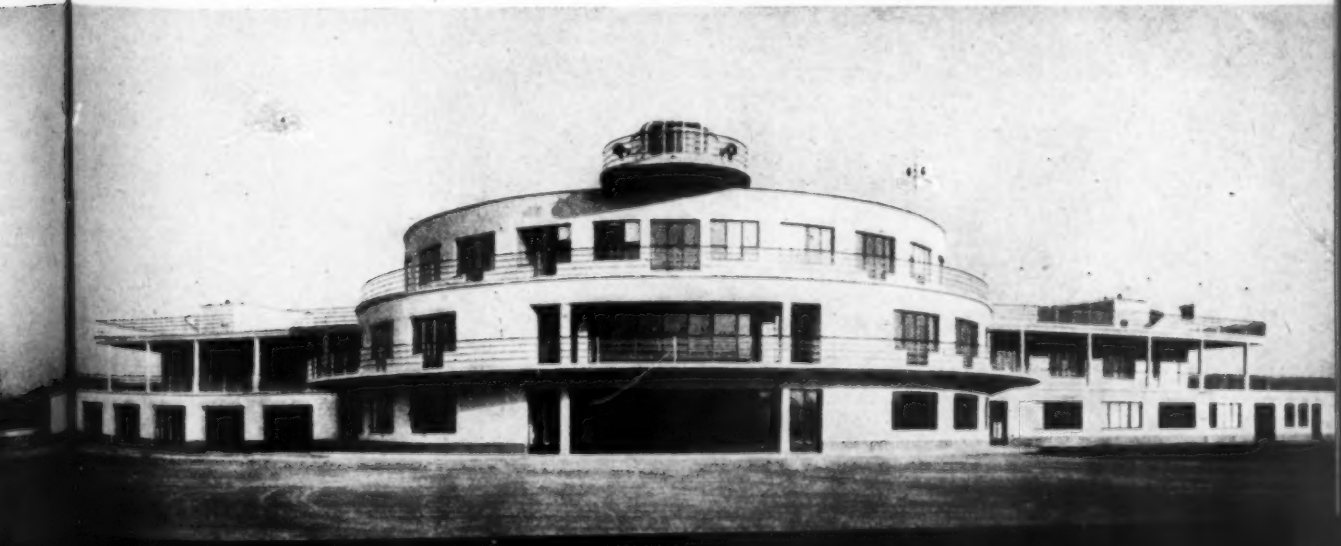
the LATEST

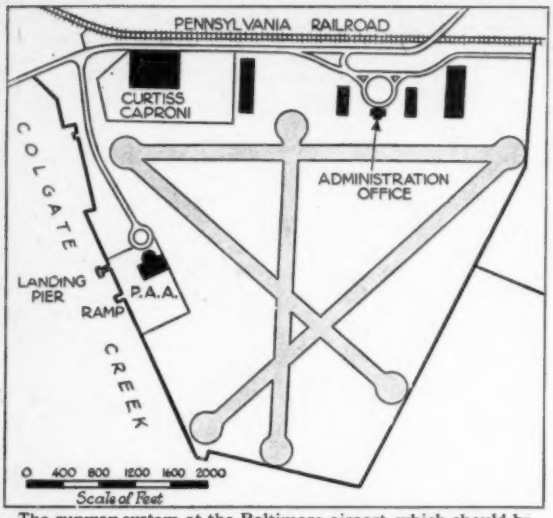
tects have Approached the Business of Planning Purposes and Traffic Potentialities

The originally conceived control tower, now completed, is the central theme of Liverpool's new airport buildings. A very complete view of the entire landing area can obviously be obtained by the control officers and the tower itself is well to one side of the blind-approach line.

Below is the terminal building at Budapest—a design which has certain superficial resemblances to the Gatwick "Martello tower" arrangement.

A land-sea airport of considerable importance on the Empire routes is that recently completed at Singapore. This photograph shows the terminal building and the two vast hangars.





The runway system at the Baltimore airport, which should be ready this summer. On the left is the loading ramp and mooring area.

nearer to the opposite shore. Runs of 2,000 to 7,000 yards are available for take-offs, with the mooring and refuelling area in the sheltered waters of Colgate Creek.

The change-over to Baltimore as a U.S. base for the Bermuda service was made largely because Port Washington is liable to be iced-up during winter, but it would seem that, following the efforts of Baltimore municipality, the base might well be a permanent terminal on the southern Atlantic service. In the meantime the necessary conversion of the North Beach Airport, New York, has been started and the completed land-sea project should be ready early next year.

THE NEW LE BOURGET

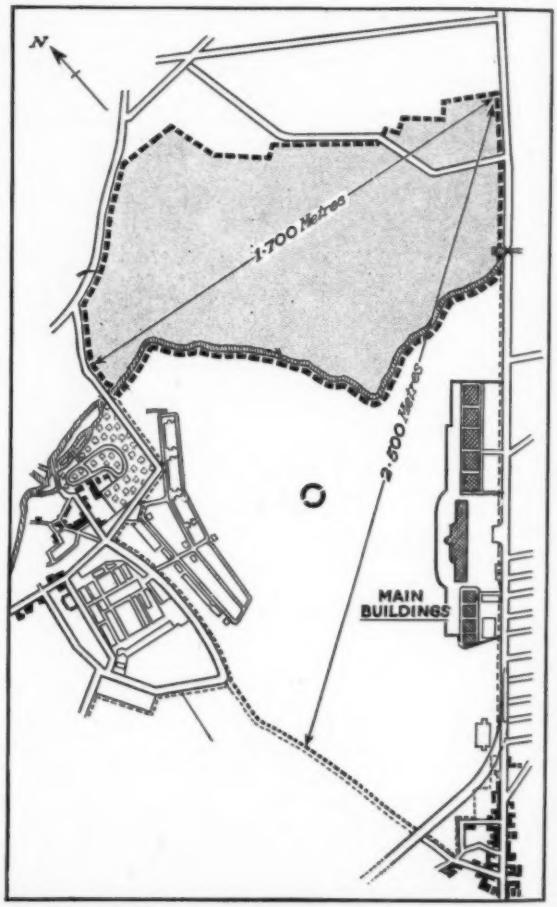
THE airport of Paris, so well known to the British travelling public, has undergone a great transformation during the past eighteen months. The numerous small frame structures formerly occupied by the various airline companies, and the two small official buildings, have been demolished and a large terminal building has been erected in their place to house all the various services of the airport.

This modern administration building was shown in a series of illustrations in *Flight* of November 18 last year. It is a steel frame structure 750 ft. long, 97 ft. in width and 39 ft. in height, situated at about the centre of the easterly side of the field. A central tower, 55 ft. high, which commands a view of the entire landing area, is located in a wing which extends outwards from the centre portion.

This new structure is built in sections so that additions can be easily made to it if desired. There are three floors, a number of exits opening directly on to the apron and on to the arrival area, and the two upper floors fronting on the airport are set back so as to furnish terraces on which 3,000 visitors may watch the flying. The whole building is exceptionally well lighted by means of large windows composed of solid panes of glass, which extend practically from floor to ceiling in all the rooms.

A large hall with a high ceiling extending along the entire length of the building occupies the rear portion of the ground floor surface fronting on the arrival courtyard. The southerly end of this hall is devoted to passenger traffic and contains a branch custom house, a police sub-station for the examination of passports and a number of booths for the sale of periodicals and so forth. Ample facilities for the speedy examination of baggage and freight are also provided and the ticket offices of the various air lines are located in the same section. The northerly end of the hall is used as a passenger waiting room. The offices of the various French and foreign airlines open on this section, and a branch post office is located at the extreme northerly end. The airline companies also have rooms on the second floor fitted with connecting staircases with those below them. Their offices on the ground floor open directly on the apron. A restaurant and a number of hotel rooms are also located in the upper floors of this northerly section.

The Commandant's offices, including those of the traffic control, radio and weather officers, are installed in the central wing which contains the control tower. The remainder of the



A plan of Le Bourget, showing the extensions which have been made to give a very satisfactory maximum run of 2.5 km. The position of the new terminal building may be seen, while below is a photograph of this building taken from a machine flying above the landing area.

upper floors of the building will be occupied by the various municipal and airline offices.

The building was designed by M. George Labro as architect, while the engineering part of the work was supervised by Mr. M. J. Cor, as chief engineer for the Air Ministry. La Société Nouvelle de Construction et des Travaux, of Paris, was the contractor. Work was started on February 11, 1936, and the building was officially opened on November 12 last year by M. Pierre Cot.

The tremendous amount of traffic and the use of modern machines in bad weather conditions has necessitated extensions to the already large landing area. The brook, termed La Moree, which formerly constituted the northerly boundary of the field, has been led through a conduit and entirely covered. Additional land has been purchased on the northerly side of this brook, thus increasing the length of the available run to a matter of 2,500 metres (8,100ft.), and a varying width of approximately 1,200 metres (3,900ft.). The increases are equivalent to about 50 per cent. of the previous area.

R. C. W.

BERLIN'S MASTERPIECE

WITH an airport only two kilometres from the centre of the city, Berlin has always had special advantages in comparison with other towns and cities. Modern airline speeds mean that the time spent in ground transport is becoming a more and more important factor in air travel. At the time when Tempelhof was laid out, very few people can have believed wholeheartedly in the future of air transport, and the far-sightedness of the Berlin authorities was all the more praiseworthy. In fact, the site of Tempelhof was previously a parade ground, and, in spite of the amount of building that had necessarily gone on in the vicinity of the airport the area and approaches were still adequate and vast spaces had been left for extensions in due course.

These extensions are now being made. Something like fifty air services arrive at and leave Berlin every day, and the plan to rebuild, and, in fact, to transform the entire airport was at least partly the result of present traffic control difficulties and of the obvious necessity for planning into the future. The project was actually originated by Herr Hitler himself.

The landing area will be three times as large as that at present in use, and will be in the shape of an ellipse with a north-west run of 2.4 km., and a minimum run of 1.7 km. All the buildings will be situated in the north-west corner, and will lie beside the southern arterial road leading from the centre of the city. These buildings are on a gargantuan scale and are designed to remove any necessity for enlargement during the coming century. Prof. Sagebiel, the designer of the Air Ministry building, has been responsible for the scheme.

Weatherproof "Platforms"

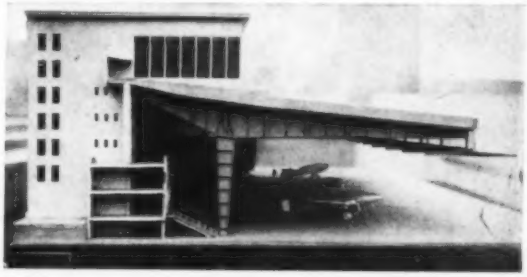
Behind a circular area of a diameter of 250 metres there are, first of all, four-storey buildings through the centre of which the visitor reaches the entrance vestibule, surrounded on three sides by colonnades. The fourth side is made up of a seven-storey building which forms, so to speak, the axis of the entire group. The three lower floors of this building form a reception hall for passengers, while below this are the freight and mail departments covering an area of 5,000 square metres. Beyond the hall, towards the airport, there is a large departure area from which passages lead to the roofed loading "platform" or tarmac.

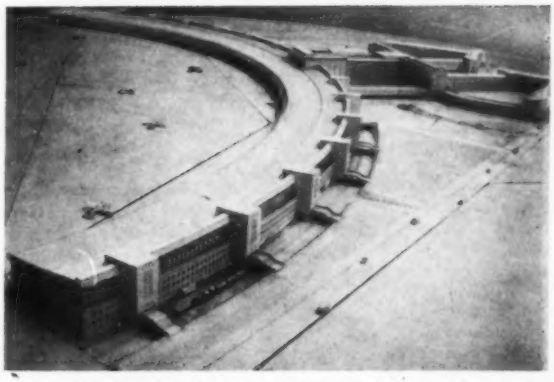
The hangars extend over an arc of the aerodrome boundary for a distance of more than a kilometre, and, while all the other buildings are of reinforced concrete, these are of steel, and the cantilever girder construction employed is particularly interesting. Large terraces are arranged on the hangar roofs to accommodate the spectators, who are so rightly encouraged at many Continental airports. Above and behind the loading area there is a large restaurant which is, of course, easily accessible from the roof. The hangars and workshops are fed by their own railway system for the transportation of goods and so forth, and there are large garages in the ground floors of the different buildings.

The offices have been designed to accommodate the entire German civil aviation administration department.

The landing area itself is almost entirely grass-covered, but there will be a 300-metre strip of concreted apron in front of the hangars and a perimeter taxying strip.

Started only eighteen months ago, the work is already advancing very rapidly. An airport worthy of a capital city.





These photographs of models of the new Tempelhof terminal show the cantilever roofing for the arrival and departure "platform," with the general layout of the whole scheme. Another photograph appears on the centre pages.

Tempelhof as it appeared before work on the new buildings was started.

Airports of To-day

NEAR-EASTERN AIRPORT

THE spread of air transport into Palestine and the fact of that country's situation on the Empire route made it increasingly necessary for the Administration to construct an airport offering every modern facility.

Gaza was, for obvious reasons, not entirely suitable. Its position so far south in Palestine, with inconvenient railway and road communications, ruled it out of serious consideration, in spite of the excellent organisation which Imperial Airways still maintain there. On the other hand, Jewish interests had for long been agitating for an aerodrome at Tel Aviv.

In spite of this, however, the Government decided that Lydda—the junction of the railways running eastwards to Jerusalem and north and south to Syria and Egypt—was the most suitable and common-sense situation, plans were laid accordingly, and work started in 1935.

In view of the fact that the aerodrome is even now anything but complete, it is difficult to write a full description; blame for this, however, cannot be laid at the door of the management, who were reluctant to hasten matters, but were pressed so persistently and importunately by transport companies using the aerodrome at Gaza that they were forced to give way in spite of the obvious drawbacks.

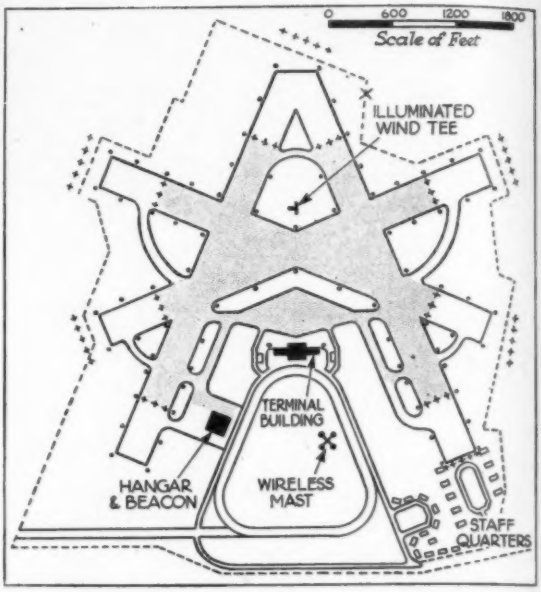
Situated in a huge plain with excellent approaches, the area is in every way an ideal landing ground. The layout is good and, in fact, every prospect pleases save only those things which must inevitably arise when a great enterprise is brought into existence before its time. For example, there are literally no facilities, no ground engineers or other services other than those provided by the Shell Company. There is no provision even for a good, comfortable meal, although this was, of course, not the case before the restaurant and offices were burnt to the ground.

The Staff

The present staff consists of Mr. D. W. Gumbley, C.B.E., I.S.O., D.C.A. in Palestine and airport controller; Mr. T. Bucton, senior supervisor; Mr. C. P. Gilroy, radio supervisor; two lorry drivers, and a mixed staff consisting of fourteen radio operators (Arabs and Jews), and twelve meteorological experts (German and Austrian Jews).

The landing area is planned with considerable forethought and ingenuity. Every runway crosses every other runway, thus providing the utmost economy in surfacing material while offering the maximum efficiency. The aerodrome consists entirely of its runways, for the soil surround (of the black cotton variety) is unreliable under most extreme conditions. When hot and dry it habitually shrinks and cracks, and when wet it swells, and the pilot who strays from the concrete is liable to run into trouble.

An example of the thought put into the layout concerns the placing of the Marconi Adcock aerials. These must be entirely segregated from any metallic fittings and have, therefore, been conveniently placed in the centre of the racecourse to the south of the terminal building. The airport is as yet unprovided with night landing facilities, but the scheme of boundary lights, with the addition of portable white cones to complete the lane of light in whatever direction is desired, will give unrivalled service when in full working order.



A typical example of modern runway layout at Lydda. The lighting system is interesting in that no floodlights are to be used, the runways being marked by white light cones, with flush-type coloured lights to indicate the end of each specially prepared section, and the usual red lights arranged on the boundary fences to show the take-off limits. On the left is a model of the terminal building itself.

The racecourse, which lies immediately behind the terminal building, is at present in a somewhat ragged state of incompletion, but the fact of its presence again shows foresight on the part of the management in the matter of potential revenue. The terminal building itself is still under construction and the radio is temporarily housed in a wooden shed adjoining the old burnt-out building. Here the writer was pleased to meet an old friend in Mr. C. P. Gilroy, the radio supervisor, whom he had not seen since his departure for Australia in the Monospar Croydon.

Fire Damage

The story of the disastrous fire throws little light upon the facts already published save, perhaps, to convince one of the fact of deliberate sabotage.

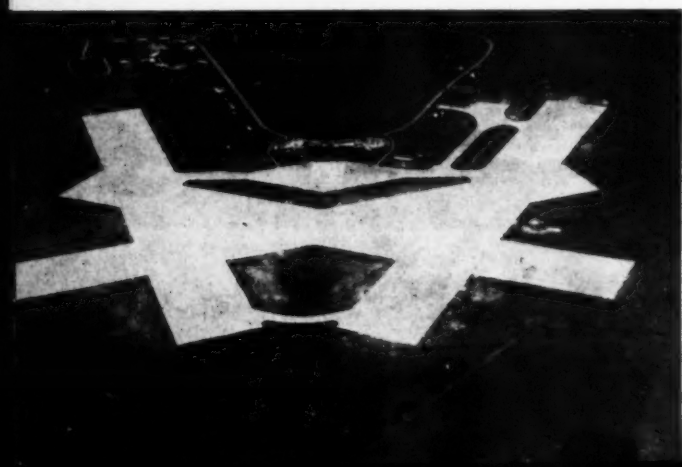
The proximity of the conflagration, unfortunately, fired the radio station, with all its expensive equipment, and the apparatus destroyed included all the normal D/F equipment, a couple of short-wave receivers and two teleprinters. With the cost of buildings themselves this represented a total loss of something in the nature of £8,000.

Within three hours of the destruction radio communication was again established by means of borrowed equipment from the R.A.F. at Ramleh, and by next evening almost complete restoration of essential services was achieved with the help of more Service equipment which was flown from Cairo.

Landing fees at Lydda are charged at the rate of ten mils for every hundred kilograms except in the case of machines without tail-wheels, which are charged double. The hangar charges are on the ordinary lines. As is only natural, Imperial Airways still prefer to use their own aerodrome at Gaza where, in spite of certain drawbacks, they can offer better service, accommodation and catering without the necessity of paying such fees. These conditions do not apply to other companies and so Lydda is the more generally used and must increase in importance as Gaza must decrease. At present the average number of landings at Lydda works out at the figure of thirty a week in the summer and twenty-two a week in winter.

Palestine, at the moment, is a torn land, seething with fear, hatred, jealousy and intrigue. Nobody can tell what the future may hold but, at least, that country has the working foundation of one of the more intelligently planned aerodromes in the world.

C. P.



An aerial view of Lydda airport as it appeared soon after the fire which has considerably delayed final development.

SOUTH AFRICAN . . . .

The Durban Base : New Services and New Equipment

SOMETHING like £100,000 is to be spent by the Union Government on the provision of the new flying boat base in Durban Bay. The Imperial boats are at present moored at a temporary site near Salisbury Island, but this will be abandoned when the new base is ready, since it involves too great a delay in the transhipment of mails and passengers to the machines which serve the Cape Province and the interior generally.

The new site which has been chosen is within a few minutes of the centre of the city, and may in time form part of a new seaplane and landplane base at the head of the Durban Bay. The local authorities have approved in principle of a scheme which will result in the creation of an airport capable of catering for the development expected within the next ten or fifteen years. The preliminary plans envisage an airport considerably larger and more up to date than the existing and modern landplane aerodrome at the north end of the city.

New aerodromes are, in fact, springing up all over South Africa, and it is the policy of the South African Railways and Harbours, under whose jurisdiction South African Airways operate, to establish emergency landing grounds at intervals of not less than fifty miles along all scheduled routes. A vast expansion scheme, which will completely change the appearance of the Rand Airport, Johannesburg, has been sanctioned.

All the most modern aids to flying are being incorporated at most of the larger aerodromes, including the Lorenz blind-approach system. The network of D/F stations is to be extended to South-West Africa in anticipation of the projected West Coast service. This service, which is expected to materialise early this year, will involve the operation of daily passenger machines between the Rand airport and the Congo, via Bechuanaland and South-West Africa. As a reciprocal gesture it is likely that the Congo lines will be linked with those of the Union, putting Antwerp within a few days' flight of Johannesburg, Capetown and Durban.

South African Airways machines are now flying regularly beyond the Union borders to the equator, and a network of feeder services is being established. The daily service of Ju 52s between Durban and Johannesburg has been augmented, and the present service of three machines a week to Capetown and back will be increased to a daily service before June. Expansion of other services is also under consideration, but is dependent largely on the delivery of the Union's recent order for seventeen Ju 86s and eleven Ju 52s, of which twelve and six, respectively, have still to arrive. The 86s, incidentally, are fitted with Pratt and Whitney Hornet engines and constant-speed airscrews. The acquisition of at least one forty-seater Ju 90 is being considered.

. . . . and SOUTH AMERICAN DEVELOPMENTS—

— With Particular Emphasis on the Argentine's Position in Air Transport

SOUTH AMERICA has, somewhat naturally, proved a grateful field for the development of air services. A net of interconnected air lines has been set up, these being fed along the coast by most of the great intercontinental unions, whose penetration into the interior is, however, as yet but slight. Owing, however, to the sparseness of the population in the interior, any further extension seems to be practicable only by means of State aid.

This problem will shortly become particularly acute, since the Aeroposta Argentina (which has maintained a service in the southern half of the Argentine since 1929) decided to extend the service in a northerly direction from Bahia Blanca to the capital, Buenos Ayres, and in a southerly direction from Comodoro Rivadavia to Rio Grande in Tierra del Fuego. The company uses three Junkers Ju.52, a type which can cover the distance from Buenos Ayres to Rio Grande (1,582 miles) in 10½ hours for this service, which is run twice weekly.

The concession granted by the Government to the company is valid for ten years, and no other company working over the same route may have support during the concession.

In addition to Aeroposta, there are four other companies operating air lines in the Argentine, two of them American and two European. Besides the German (Lufthansa-Condor-Syndicate) and the French (Air France) companies, an English (British Airways) and an Italian company are expected to open services to the Argentine in due course.

A few weeks ago the Argentine Government bestowed its approval on the Lufthansa proposal to operate a service to Santiago de Chile, so that now the D.L.H. machines can travel the whole way from Germany through Brazil, Uruguay and Argentine to Chile. The Condor Syndicate, a subsidiary of D.L.H., had formerly operated an internal service linking up with the European service. As is well known, a French and a German service make the Europe-South America journey weekly in both directions.

The two American companies connecting with North America are "Panair" (Pan-American Airways, Inc.), which operates a weekly service from Miami over Central America, Brazil and Uruguay to Buenos Ayres, and "Panagra" (Pan-American Grace Airways, Inc.), which operates a service over Central America, Peru, Ecuador and Chile to the Argentine.

Each of the two companies, which are incorporated in Pan-American Airways, has recently obtained important concessions from the Argentine Government. "Panair" will unite Paraguay with Argentine in the south and with Brazil in the north. This service will run from Buenos Ayres, with landings at Concepcion de Uruguay, Monte Caseros, Goya, Corrientes and Formosa, to the capital of Paraguay, Asuncion, and from there to Brazil, where it will connect at San Paulo with the line already established along the coast. At all these centres new landing grounds are to be laid down. A similar concession on the east coast has been granted to "Panagra." This company will inaugurate a weekly service along the route Buenos Aires-Tucuman-Salta-Jujuy-La Paz, the Bolivian capital, while the further extension to Lima, in Peru, where it will connect with the west coast lines, will be made in the future.

On the basis of a comparison of the 1936 and 1933 traffic figures and the expectation of new developments, the figures for the present year may be expected to show a further considerable improvement.

THIS ICE FORMATION

NOT very long ago a British machine landed at a certain Continental airport with an even coating of clear ice covering almost the entire structure. For an hour and a half the ground staff worked on it with brushes and hot water, and in due course the cleaned-up machine left for London. Ten minutes later the pilot returned with a similar coating on the machine and necessarily ceased business for the day.

This sort of thing occurs now and again throughout the winter months, though the general public only hears of ice formation when any machine suffers a genuine forced landing or is involved in an accident from this cause. Little by little the basic reasons for such formation are being duly tabulated, though it still comes as a surprise to many people to learn that there are quite a large number of different types of formation, many of which, though fearful to look upon, are almost innocuous in actual fact. Generally speaking, it is only in certain parts of Central Europe that very severe and rapid formations are experienced, and we must look to the meteorologist to provide the necessary information so that pilots need never fly into dangerous areas.

The latest publication from the Meteorological Office, in the form of *Professional Notes No.* 81, is concerned with ice formation conditions in this country and is obtainable from H.M. Stationery Office at the distinctly reasonable price of 6d.

Mr. W. H. Bigg, the author of the notes, deals fully with the physical processes involved and gives a clear explanation of the different types of formation which may be expected in different conditions. A number of tables are given of all the facts relating to formations in different types of cloud and at different temperatures, and a number of interesting cases are described in detail.

The pamphlet, which covers thirty-five pages, should certainly be studied by all transport pilots, meteorologists and control officers

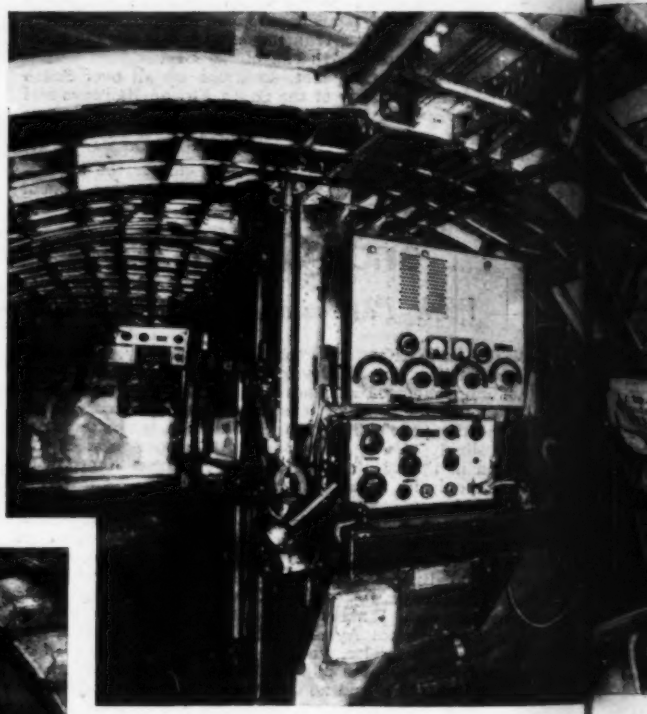
THE FUTURE of AIRCRAFT RADIO

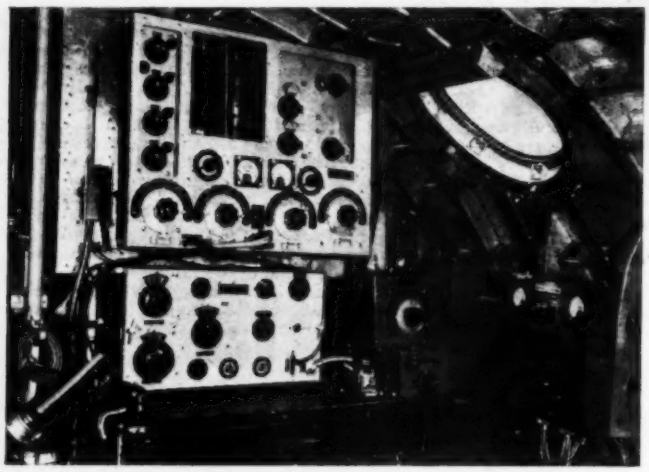
Modern Trends and Likely Developments : Some of the Difficulties Involved : Dissecting the Problems in the Different Services

By H. M. SAMUELSON

THE progress made in the development of the world's aircraft radio services has tended to lag behind that made in air transport itself, with the result that, taking the broad divisions of Europe and America, the demand for certain changes is likely to be met in the near future. The shortcomings of the present systems are not entirely the fault of the radio engineers who planned the equipment on the ground or in the air, but rather are they the result of economic and international difficulties.

For instance, the present arrangement, whereby most of the direction-finding in Europe is done at the ground stations, is both accurate and speedy where only one or two machines must be attended to, but it fails badly under heavy traffic conditions. This state of affairs has been apparent for some time, but before any changes could be made it was necessary to consider the extent of the investment in existing plant and the capital cost of any new system in every country served by international air routes.





A good example of modern aircraft radio installation—the very complete Marconi equipment in the Short Empire boat. On the left is a close-up of the sets with various parts uncovered for inspection. This installation comprises long and short wave two-way equipment with a rotating loop, which may be used either for obtaining bearings or for homing, and a self-contained generating station, part of which may be seen in the lower right-hand corner of the larger picture.

It does not seem probable that any revolutionary methods of communication or direction-finding will be adopted wholesale at any time, since changes in ground station equipment call for corresponding alterations or additions in aircraft radio apparatus. New systems will at first need to be auxiliary to those existing—as in the case of the radio compass which, used in conjunction with special beacons, does not replace the aerodrome direction-finding service, but is used to supplement it.

For the sake of convenience in attempting to forecast the trend of the aircraft radio services, we might divide the latter under the several headings of which they are composed as regards their functions, each one being further sub-divided as necessary: (1) Point to point; (2) meteorological; (3) air to ground and ground to air communication; (4) direction finding, (a) medium distance and (b) long distance; and (5) approach and landing.

These services will be examined in turn, chiefly with reference to commercial aviation in Europe, so as to see where the existing methods are likely to be retained and where improvements are desirable. Naturally, many points are of a controversial nature, and local conditions, peculiar to one country or air route, may not fit in with the rest of the picture. Prophesy is always rather dangerous, and with so many variables to play with it would be rash to forecast that any one system or method will ultimately prevail. Likewise, from the pilots' point of view, many things are desirable but are not found to be feasible in radio practice. Hence, an endeavour has been made to take an average line of reasoning to satisfy the many interests involved.

(1) *Point to Point Services.*—These are inter-aerodrome links used for the passing of routine messages, arrival and departure notices, and so on. Owing to the crowding-up of all wavelength bands, teleprinters are now replacing radio equipment for this work even though the latter has passed down from about 1,200 metres wavelength to 107 or 55 metres. This particularly applies to the network of aerodromes in one country, i.e., Germany.

Provided that the speed and accuracy of messages are not affected, flying personnel have no interest in how this class of communication is carried out, the technical problems being the responsibility of communication engineers.

One interesting system that has been working for some

Croydon's radio department with the three two-way installations —two for normal work and the third (on the right) for short-range controlled-zone operations in QBI conditions. A telewriter is now used for rapid communication between the operator and the control officer in charge.

time is the Microray (18 centimetre wavelength) radio link which connects the cables on the French and English side across the Channel between Croydon and Le Bourget. Owing to the electrical characteristics of these ultra-short waves they can only be used under certain conditions, the most important of which are that the two terminals must be within optical range of each other. For this reason their application is somewhat limited, and it seems probable that teleprinters and cables will continue to replace radio equipment for aerodrome ground services on the busier routes.

(2) *Meteorological Services.*—The collection and dissemination of weather reports is on an international basis. Radio transmission is employed both by secondary stations reporting to the head of their group and by the head in broadcasting the observations of the area under its control. The broadcasts are of interest to aircraft in flight, since the transmissions are at stated times and, being in the form of an international code, can be read by all. This is one argument for the retention of radio transmission for this class of work, since in many cases it avoids the necessity for a pilot to call up the ground station to ask for a weather report on the already overworked aircraft wavelength. Secondary reporting stations can, of course, use telephone or teleprinters for sending data to the area control.

The wavelength used for these main transmissions is scheduled for about 1,200-1,300 metres, but Croydon uses the "aircraft" wave (900 metres) to broadcast the local report, so that the operators keeping watch on this wave need not transmit demands for this information. In this connection it is worth while remembering that a little intelligent listening may often avoid the necessity for transmission. The wavelengths used in the future for this service are closely bound up with the air-to-ground and ground-to-air communication problem which is dealt with below. With the advent of Transatlantic and Transpacific services, the aircraft can do work as valuable as can the ground organisation by reporting local weather conditions, thus two-way communication is necessary.

Within the past few years picture transmission by radio has become a commercial achievement, and this opens up the prospect of complete weather maps being "transmitted" to long-distance aircraft. In the case of airship work, in particular, there are many people who think that it is best to navigate by the weather map and not by straight line or great circle methods, and with increased aircraft speeds and range it is quite possible that the air mass chart may become as important as the orthodox route map or marine chart.

One form of weather reporting which is likely to become of more all-round value is radio telephony broadcasting, as at present given by Borough Hill on 1,224 metres. This wavelength has had to be altered several times due to interference from, or to, broadcasting stations, but the main idea of the service is good, and it could be carried on another wavelength if a further shift is inevitable. If each country had its own corresponding station, private flying would be aided considerably and the information would not be despised by the air lines.

The Present Channel

(3) *Air to Ground and Ground to Air Services.*—In Europe civil aviation radio communication started on 900 metres and, except for small extensions of the wavelength band from time to time, the majority of the traffic still passes at those frequencies.

Apart from the fact that in 1920 the vagaries of short-wave transmission were not thoroughly understood, the adoption of 900 metres wavelength presented several attractions for the aircraft services. First, it enabled reasonably accurate direction finding to be done at the ground receiving point, and, secondly, transmissions on that wavelength were much more reliable in range and constancy over a period of time than those of the higher frequencies.

The first reason is probably the one for which the present method has been retained as, with the advance of radio science, the trend for purely communication use is the employment of short wavelengths at the expense of medium and long waves, especially where long distances have to be covered. For two-way communication alone, the United States civil air lines almost exclusively operate by telephony on 50 to 100 metres, and reserve the 1,000-metre band for their navigational beacons.

With this improvement in radio technique it is probable

An example of the Adcock type of ground D/F receiving aerial system—actually that at Honolulu used for short-wave work on the Pacific services.

that all over the world the aircraft radio services will make increasing use of short waves for their two-way communication if an alternative direction-finding band can be found. In a given frequency band, say, 30 to 40 metres, dozens more communication channels can be operated without mutual interference as compared with the band of 822 to 938 metres, which is now hopelessly overcrowded. Furthermore, under tropical conditions, where severe static interference is found, it is often only a 45-metre wavelength call which can be got through when the 900-metre transmission is unreadable a few miles away. These facts were, of course, appreciated during the opening of the Imperial Airways Empire routes, and for this reason their machines were equipped with dual-wave radio sets—40 to 80 metres and 550 to 1,200 metres.

During these flights experiments were made in long-range communication (2,000-3,000 miles), using the 40- to 80-metre band, and these data, coupled with those obtained on the transatlantic experiments, have shown that there is now practically no limit to the range obtainable. Naturally, wavelengths must be altered to suit the time of day and distance to be covered.

From this we can easily visualise the elaboration of the aircraft radio set into something approaching a miniature ground station, especially as the size of the machines employed is growing and reasonable consideration is given to the location and space of the radio cabin. It will probably be a long time before all aircraft radio traffic shifts down from the longer waves since, for instance, there is always the necessity for communication with shipping, the smaller class of which uses 600 metres. It does, however, seem fairly certain that dual-wave sets will be more widely adopted and, furthermore, that the individual units may be duplicated for the sake of safety. This latter feature would seem reasonable when remembering that the aircraft engines are at least in duplicate and that with the modern technique of flying a radio failure may be more serious than an engine failure.

As in the case of shipping, the type of radio set fitted to aircraft will be governed by the size and duties of the latter. The private owner and small airline operator present the worse problem from the equipment point of view, as weight and cost are prime considerations to them. Perhaps something of interest may emerge from the coming Cairo conference, but it should be realised that an improvement in operating conditions (such as freedom from interference) may lead to more expensive equipment. For instance, a short-wave transmitter should be crystal-controlled for stability, and for successful reception efficient ignition screening must be provided, both of which features add to the expense of a typical radio installation as at present in service.

The question of whether telephony or telegraphy operation will predominate will probably depend on the operating wavelength employed. Certainly no increase in telephony can be expected so long as the 900-metre band is used. On international airlines telegraphy has the advantage in the "Q" code system, which avoids language difficulties. For the largest type of machine it is not outside the bounds of possibility that a special telephony service be provided for the use of passengers. There is certainly no technical reason against it at the present moment, but its adoption is far more likely to be governed by payload and Government regulations.

(4) *Direction-finding Services: (a) Medium Distance.*—As already explained the continuance of the 900-metre band has largely been due to the suitability of this wavelength for direction finding. Admittedly, it is subject to "aeroplane effect" and "night effect," but certain versions of the Adcock receiving aerial system have gone far to minimise these troubles. On the other hand, we are only just beginning to obtain any data on a large scale for intermediate or short-wave direction finding.

It is now universally recognised that the direction finders located at the aerodromes are badly overloaded during adverse weather conditions and in heavy air traffic. This trouble would still be apparent on any wavelength unless some system of regional frequencies was employed—which would demand more effort from the aircraft crew.

Self-contained Equipment

Recently there has been a move to fit direction-finding receivers on the aircraft and to use broadcasting stations and either marine or the new special air beacons for taking bearings. Undoubtedly this helps in relieving the load on the ground organisation, but there are one or two factors which should be more closely examined before regarding this new development as solving the difficulty. First, it is obvious that the most efficient (and hence, probably, the most accurate) work can be done at a fixed point on the ground and not in an aircraft which may be bumping through bad weather at some 200 m.p.h. Secondly, the adoption of a special aerial system on the ground, e.g., the Adcock type, minimises error due to "night effect" and other transmission phenomena, whilst the aircraft fitting must at the best be a rotatable loop, which is, by comparison, a very primitive device. The improvement of its characteristics might well occupy the attention of engineers.

Direction finding over medium distances, as flown in Europe, may therefore continue on the present lines with special developments on direction-finding receivers for aircraft use. Technical developments, such as the "impulse sender," will come into being from time to time so that the accuracy may be improved. It is also quite possible that the use of the V.H.F. beacon, as exemplified by the Lorenz system, may be extended from being merely an approach and landing device to its employment as a medium-distance navigational aid. Both in Australia and America work is being done on this subject.

It is interesting to note that America, the home of the

medium-wave equi-signal beacon system, has also suffered major difficulties due to the growth of air traffic and changing flight technique. Although in theory any number of aircraft can use an equi-signal beacon without mutual interference, it must be realised that this system has given a lot of trouble through the "swinging" of the beam due to mountainous country, and that once an aircraft is off its course there is nothing to tell the pilot how far he has wandered from the desired track. For this reason, since January 1, 1938, it has been compulsory for commercial aircraft to be fitted with a direction-finding receiver.

Mention has already been made of special aerial systems used to minimise "night effect." The latter is a combination of direct and reflected ray which, besides giving large errors in direction-finding work, also produces fading which is more familiar to users of broadcast receivers. Some of the latest broadcasting stations use one large vertical tower (up to 900ft. high) as a radiating device intended to minimise fading, and it seems reasonable to suppose that if these broadcasters are used for taking bearings in the air the results would be less subject to error.

Omni-directional Beacons

For a considerable number of years shipping has been aided by special coastal radio beacons which enable bearings to be taken on board ship through a comparatively simple direction finder. These beacons operate in turn to a set schedule, and, theoretically, the transmissions are omni-directional. Working on the same principle, a network of omni-directional air beacons are being put into service in Europe, utilising a wavelength of 1,128 metres. Particulars of the transmissions of the Croydon beacon are given in Air Ministry *Notice to Airmen*, No. 2 of 1938, and were detailed in *Flight* last week.

Reviewing the above, it seems that for medium-distance work there are going to be improvements but no revolutionary changes in the direction-finding services. It is in long-distance navigation, especially overseas, where many difficulties have yet to be overcome.

(*b*) *Long-distance Navigation*.—Whether medium- or short-wave transmissions are used, there is always the baffling "reflected ray" and the associated "skip distance" to contend with at long distances. In fact, it is mainly through the indirect ray that communication, especially on short waves, is possible over 300 miles or more. Luckily, the fact that an aircraft is at a height above the earth minimises some of this trouble, and the possibility of a cruising height of 20,000ft. may materially aid radio operation, especially on the sea routes.

Long-Range Experiments

Pan-American Airways have developed their own version of the Adcock receiving aerial, and, taking observations in intermediate and short-wave transmissions, claim to get an accuracy of better than 2° at distances of more than a thousand miles on their Pacific route. On this side, also, the radio companies and Imperial Airways are experimenting on long-distance short-wave direction finders.

Since transatlantic flying will not for many years reach the stage at which traffic congestion is likely to become a problem, it will probably be better if the direction finding is done at the ground station, which could be supplemented for medium-distance and approach work by the direction-finding receiver of the aircraft. There is also the opportunity, during flights of this nature, to use celestial navigation to supplement the radio services.

It is apparent that in this class of navigation it is not a question of replacing any existing system, but rather of *ab initio* development, which is chiefly a radio engineering problem. Naturally, during such an experimental period the radio companies are rather reticent, but there can be no doubt that in time the problems will be solved.

(5) *Approach and Landing*.—One of the most pressing needs of all aircraft operation is a satisfactory blind approach and landing system. Full credit is due to the Lorenz company of Berlin in getting standardised in Europe to-day a system which is as good as can be demanded for assisting the pilot during his last few miles into the airport, and which is, at the same time, an aid to the actual landing.

There remains much to do, however, to improve the ease of landing under virtually blind conditions; and although the Lorenz system can, and has been so used by experts, even its originators will admit that there is room for improvement. Perhaps some of the difficulty has been that the aircraft has had to select one from a number of curved flight paths, the choice of the correct one being obviously controlled by the machine's characteristics.

In America some interesting experiments are taking place with an automatic pilot coupled to the flight path indicator, and some devices go even farther by controlling the engine throttles by the blind-approach receiver. It may be questionable whether this degree of mechanisation is advisable, as, should any one link in this chain of devices go wrong, the pilot might be left with a very awkward situation with which to deal. Most of the American systems use the straight-line glide-path principle, which means, in effect, that the machine is flown on to the ground and the engines cut after contact. This probably works out well on a 1,500-yard concrete runway, but might lead to some exciting results when tried on the Croydon Alps.

The straight-line glide does, however, open up very interesting possibilities when practised in conjunction with a tricycle undercarriage. In this case the pilot has not got to contend with so many variables, and a misjudgment near the ground may not have the more serious consequences associated with a similar performance on the present-day type. The radio engineer can provide most forms of beam to order, but the aircraft designer certainly ought to make a contribution.

Blind-Approach Development

At the present moment the main beam of each installation is fixed along the axis giving an approach line to the airport which is most free of obstructions, and hence assumes conditions of no wind such as obtain in fog. There are times, however, when there is a combination of very low visibility and a wind the direction of which may not coincide with the track of the beam, and experiments have been made in switching the output of the beacon from one antenna array to another. A mobile beacon mounted on a motor truck has also been produced, complete with self-contained marker beacons, and this may prove of value under some conditions.

It does seem to be fairly established that the ultra-short wavelengths will be used on all blind-approach and landing systems, these wavelengths being at present about 9 metres for Europe and from 3 to 5 metres in America. Such installations are now recognised as being part of the constitution of the aircraft radio services, and it only remains for the equipment to pass through the successive development stages associated with any new product.

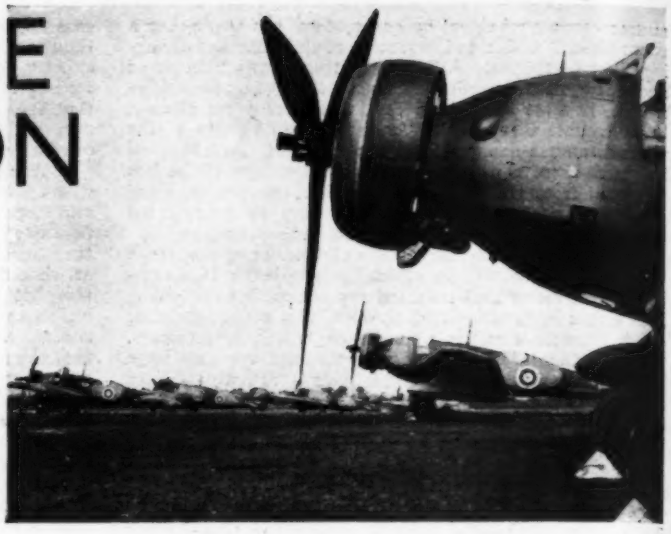
There will probably be interesting comparisons to be drawn soon between the completely mechanised blind landing, such as is aimed at in the United States, and a combined manual and automatic landing over here. Perhaps a compromise may be arrived at whereby the aircraft is controlled directionally by an automatic pilot, leaving the man in charge free to concentrate on "letting down" to the ground. Whichever method wins out eventually there is a grave responsibility on the designers to ensure that a pilot is not forced, through a failure, into a situation which cannot be handled without the equipment.

Space does not permit the consideration of the trend of the various types of equipment used in the different services. The ground apparatus represents, in the main, the progress of radio design alone, but the equipment on the aircraft is subject to more than purely radio considerations. The design of anti-static aerials alone has occupied many hours of research and flight test, whilst field-strength data accepted for point-to-point working have had to be replotted for air communication use.

Radio facilities for the private owner forms another vexed question, and it is to be hoped that, since this problem is down for discussion on the agenda of the forthcoming Cairo conference, some foundations will be laid for this hitherto neglected service. Each phase of aircraft radio practice is becoming more specialised, but, as they are all interdependent, only continual contact between air transport, aircraft design and radio engineering can ensure the desirable result of safety in the air.

SERVICE AVIATION

Royal Air Force and Official Announcements : Fleet Air Arm News : Military Aviation Abroad



VICKERS WELLESLEY medium bombers, complete with bomb carriers, awaiting the arrival of Service pilots to ferry them to depots or squadrons

Honorary Air Commodores

THREE well-known gentlemen who have never served in the R.A.F. have been gazetted as Hon Air Commodores. Mr. W. L. Everard, M.P., has been given that rank in No. 605 (County of Warwick) (Bomber) Squadron of the Auxiliary Air Force; while Brig.-Gen. A. C. Lewin, of King's Cup and Nile Sndd fame, and Rear Admiral C. H. G. Benson, D.S.O. (rtd.), have been gazetted to the same rank in the R.A.F. Volunteer Reserve.

No. 8 Flying Training School

THE undermentioned officers have been awarded special assessments on completion of a course of flying training at No. 8 Flying Training School, Montrose: *Distinguished Pass.*—A.P/O.s J. S. Danby, T. A. Heath, G. A. Pickett, R. L. Porteous.

Combined Operations at Singapore

THE Admiralty, War Office and Air Ministry announce that a combined operations exercise will be held at Singapore at the beginning of February. Ships of the Royal Navy and of the Royal Indian Navy, troops of the Singapore Garrison and R.A.F. squadrons stationed at Singapore, reinforced by units from India and Iraq will take part.

Transfer of Officers to the Reserve

THE undermentioned medium-service and non-permanent officers should note that they become due in June and July for transfer to the reserve:—

General Duties Branch.—Sqn. Ldr. Noel William Aubrey Cullum, and Flt. Lt. Walter Roy Munro Higgs.

Dental Branch.—Flt. Lts. Kenneth Gordon Swiss, L.D.S., and Henry Malcolm Gill Williams, L.D.S.

Central Flying School

THE undermentioned officers and airman pilots who attended the flying instructors' course at the Central Flying School from August 23 to November 6, have been categorised as under:—

A.2.—F/O.s P. S. Hutchinson and V. H. P. Lynham.

B.—Flt. Lts. W. E. Cameron, H. J. L. Hawkins, G. R. Howie, M. H. Kelly, E. B. King, E. V. Knowles, L. S. Lamb, H. G. Lee, N. W. D. Marwood-Elton, R. H. Maw, O. A. Morris, A. G. Strutt, A. Threapleton; F/O.s S. S. Bertram, E. L. Colbeck-Welch, G. W. Golledge, J. E. C. G. F. Gyll-Murray; Flt. Sergts. J. E. Atkins and G. A. Clarke; Sergts. E. V. Asplin, H. D. Bisley, R. T. Bradshaw, R. H. Payne, A. P. Peskett, F. C. Standen.

C.—Flt. Lt. F. E. H. Cooper, F/O. P. E. Meagher; Sergts. F. J. B. Moore and S. P. Smith.

Strength of the R.A.F.

THE end of 1937 found the Metropolitan Air Force with a total of 123 squadrons, with 1,542 first-line aircraft. This compares with 88 squadrons, with 1,076 first-line aircraft, at the beginning of the year. The corresponding figures when expansion began in May, 1935, were 53 squadrons and 580 aircraft. In addition to the force at home there are 26 squadrons overseas, including those in India, with 272 first-line aircraft, and the equivalent of 20 squadrons in the Fleet Air Arm, with 217 first-line aircraft. The total strength of the R.A.F. thus includes 169 squadrons, or exactly 100 more than the strength ten years ago.

There are several squadrons of Blenheims, Wellesleys, Whitleys, Harrows and Battles, and in a few months a number of units will have been equipped with Hurricanes, Spitfires, Hampdens, Wellingtons and Lysanders.

Royal Canadian Air Force Aircraft

THE Canadian Department of National Defence has placed orders for three additional Supermarine Stranraer flying boats and nine more Northrop Delta cabin monoplanes for the R.C.A.F.

The Medical Branch

THE undermentioned medical officers have been selected for permanent commissions, subject to physical fitness: Flt. Lts. Peter Astley Cooper, M.R.C.S., L.R.C.P., Lewis Mackenzie Crooks, M.B., Ch.B., John Robson Roose Jenkins, M.R.C.S., L.R.C.P., Sidney Richard Carlyle Nelson, M.D., William Percivale Stamm, M.B., B.S., M.R.C.S., L.R.C.P., Gordon Hackworth Stuart, M.B., B.S., M.R.C.S., L.R.C.P.

Imperial Defence College

THE following officers have completed satisfactorily a course at the Imperial Defence College, which terminated in December, 1937, and are entitled to the letters "*i.d.c.*" after their names in the *Air Force List*:—Group Capts. R. P. Willock, *q.s.*, K. R. Park, M.C., D.F.C., *p.s.a.*, A. H. Orlebar, A.F.C., *p.s.a.*, J. O. Andrews, D.S.O., M.C., *p.s.a.*, Wing Cdrs. A. L. Fiddament, D.F.C., *p.s.a.*, and A. B. Ellwood, D.S.C., *p.s.a.*

Permanent Commissions

MANY short-service officers are anxious to obtain permanent commissions and make the Royal Air Force their career for life. The Air Ministry has published a reminder that officers are eligible for permanent commissions only if they have completed more than three, but less than four, years on short-service commissions.

In 1935 a number of officers of more than four years' service were granted permanent commissions as an exceptional measure, but it is not expected that the concession will be repeated.

New Station Headquarters

A STATION headquarters will form at Cottesmore, Oakham, Rutland, on March 11, on which date the station will be placed under the command of the A.O.C.-in-C., Bomber Command, in No. 2 (Bomber) Group.

The aerodrome may be used with effect from February 12 for aircraft of personnel visiting the station on duty in connection with the opening, but no facilities of any kind will be available. The aerodrome will not be available for general use until April 20.

A station headquarters formed at Lee-on-the-Solent on January 1.

Selection Board in Scotland

ARRANGEMENTS have been made for the Selection and Medical Boards for candidates for Short Service Commissions to be held in Scotland. The first of these boards will be held at the Town Headquarters of No. 602 (City of Glasgow) (Bomber) Squadron on Friday, February 4, and it is proposed to hold further boards at monthly intervals. Candidates living in the North of England may, if they prefer, be interviewed in Glasgow, and should apply to the Secretary (S.7(e)), Air Ministry, for permission to be examined in Scotland. The inception of this Selection Board will obviate the necessity for candidates residing in Scotland or the North of England having to travel to London.

Prospective candidates may be reminded that Short Service Commissions are granted by selection to candidates between the ages of 17½ and 25 years who have attained at least the School Certificate standard of education. The period of service is four years in the first instance followed by six years on the Reserve.

No. 35 (Bomber) Squadron Reunion Dinner

NO. 35 (B.) Squadron held its Coming-of-Age dinner in February last year, and it is hoped that the success which attended this function will be repeated when the annual dinner is held this year. This takes place at the Royal Air Force Station, Worthy Down, near Winchester, on Friday, February 4, 1938, at 8 p.m. for 8.30 p.m., and all ex-officers of the squadron are invited to attend.

The charge for the dinner will be ten shillings and either Mess dress with decorations or evening dress will be worn by ex-officers.

Applications and enquiries should be addressed to G. McKerrow, Esq., Dorrator, The Firs, Bowdon, Cheshire.

Flying Accidents

THE Air Ministry regrets to announce the following accidents:—A.P/O. Martin Henry Bromley Davies and L.A/C. John Hockings Campbell lost their lives in an accident which occurred at Mansur, near Khormaksar, on January 11 to an aircraft of No. 8 (Bomber) Squadron, Aden. A.P/O. Davies was the pilot.

P/O. Geoffrey Burr Andrews and A/C.1 Novel Everard Boon lost their lives in an accident which occurred at Holworth, near Dorchester, on January 14, to an aircraft of No. 6 Armament Training Camp, Woodsford, Dorchester, Dorsetshire. P/O. Andrews was the pilot.

Royal Air Force Gazette

General Duties Branch

Capt. (local Maj.) I. O'B. MacGregor, Royal Artillery, is granted a temporary commission as Squadron Leader on being reseconded for duty with the R.A.F. (January 1).

Cdr. G. Willoughby, R.N., is reattached to the R.A.F. as a Squadron Leader with effect from December 28, 1937, and with seniority of January 1, 1936; F/O. J. R. Gillman is promoted to the rank of Flight Lieutenant (December 24, 1937). Flt. Lt. R. A. R. Rae is restored to full pay from half-pay (December 31, 1937); Lt.-Cdr. I. R. Grant, A.F.C., R.N., Flt. Lt., R.A.F., ceases to be attached to the R.A.F. on return to Naval duty (December 31, 1937); Sqn. Ldr. H. J. Saker, M.V.O., is placed on the retired list at his own request (January 8); Flt. Lt. C. Walker is placed on the retired list at his own request (January 11).

Medical Branch

Flt. Lt. J. W. Patrick, M.B., B.Ch., D.P.H., is granted a permanent commission in that rank (January 7); Flt. Lt. A. W. Smith, M.B., B.S., is granted a permanent commission in that rank (January 7); F/O. V. D. Jones, M.R.C.S., L.R.C.P., is promoted to the rank of Flight Lieutenant with effect from May 4, 1937, and with seniority of May 4, 1936; Flt. Lt. R. G. James, M.R.C.S., L.R.C.P., is transferred to the Reserve, class D. (January 7); Flt. Lt. D. R. Crabb, M.B., B.S., M.R.C.S., L.R.C.P., relinquishes his short service commission on account of ill health (January 8).

Dental Branch

Flt. Lt. A. Maben, L.D.S., is transferred to the Reserve, Class D. (January 7).

Princess Mary's R.A.F. Nursing Service

The following are appointed to the permanent service (January 1):—SISTERS.—Miss J. S. G. Blair, Miss D. Gadd, Miss F. M. Crocker, Miss J. F. I. Woods. STAFF NURSES.—Miss J. M. Mallalieu, Miss E. M. Knox, Miss E. M. M. Wells, Miss D. M. Dixon, Miss E. M. Guinness, Miss J. Mitchell, Miss M. Swales, Miss J. M. West, Miss E. N. Blackman.

Senior Sister Miss N. G. Rees, A.R.R.C., is promoted to the rank of Matron (January 10); Sister Miss M. H. Adamson is promoted to the rank of Senior Sister (January 10); Matron Miss W. E. Molesworth, R.R.C., is placed on the retired list on account of ill health (January 10).

Royal Air Force Reserve

General Duties Branch

Flt. Lt. R. C. Savery, D.F.C. (R.A.F., Ret.) is granted a commission in that rank in Class C (November 29, 1937); Flt. Lt. C. R. Vaughan relinquishes his commission on completion of service and is permitted to retain his rank (August 12, 1937).

Equipment Branch

Capt. W. H. Anderson, R.A.R.O., is granted a commission as Flight Lieutenant in Class C (July 19, 1937).

Royal Air Force Volunteer Reserve

General Duties Branch

Bt. Col. (Hon. Brig. Gen.) A. C. Lewin, C.B., C.M.G., D.S.O., A.D.C., is appointed Honorary Air Commodore (December 28, 1937); Rear Admiral C. H. G. Benson, D.S.O. (R.N., Ret.), is appointed Honorary Wing Cdr. (November 15, 1937).

Auxiliary Air Force

General Duties Branch

No. 605 (COUNTY OF WARWICK) (B.) SQUADRON.—W. L. Everard, M.P., D.L., J.P., is appointed Honorary Air Commodore (January 4).

Royal Air Force Appointments

General Duties Branch

Air Commodore.—T. L. Leigh-Mallory, D.S.O., to H.Q., No. 12 (F.) Group, Hucknall; on appointment as Air Officer Commanding, 14.12.37.

Squadron Leaders.—A. Allen, to No. 70 (B.)T.) Squadron, Dhibban, Iraq; for flying duties, 15.11.37. E. L. Mole, to No. 4 F.T.S., Abu Sueir, Egypt; for Engineer duties, 2.12.37. P. Kinsey, to H.Q., R.A.F., Iraq, Hinaidi; for duty as Chief Signals Officer, 18.11.37. R. A. A. Cole, to C.F.S., Upavon; for Administrative duties, 20.12.37. A. P. Revington to H.Q., Training Command, Market Drayton; for Navigation duties, 18.12.37. H. A. Haines, D.F.C., to No. 148 (B.) Squadron, Scampton; to command, 4.12.37. F. V. Beamish, to No. 64 (F.) Squadron, Martlesham Heath; to command, 8.12.37. J. E. M. Bainbridge, to R.A.F. Station, Lee-on-Solent; for flying duties, 17.12.37. C. C. O'Grady, to H.Q., No. 23 (Training) Group, Grantham; for Armament duties, 21.12.37. H. H. Chapman, to H.Q., No. 22 (A.C.) Group, South Farnborough; for Signals duties, 21.12.37. J. G. W. Weston, to Directorate of Signals, Air Ministry, 23.12.37. C. R. Lousada, to No. 22 (A.C.) Group, South Farnborough; for Air Staff duties, 21.12.37.

Flight Lieutenants.—B. W. Knox, to No. 72 (F.) Squadron, Church Fenton, 18.12.37. C. Ryley, to Marine Aircraft Experimental Establishment, Martlesham Heath, 20.12.37. D. W. Bayne, to No. 3 (F.) Squadron, Kenley, 22.12.37. W. J. Hickey, to H.Q., No. 26 (Training) Group, Hendon, 1.12.37. G. E. MacDonald, to No. 8 Armament Training Camp, Evanton, 3.12.37. C. R. D. L. Lloyd, to R.A.F. College, Cranwell, 27.11.37. C. F. C. Wright, to No. 604 (County of Middlesex) (F.) Squadron, Hendon, 2.12.37. E. T. Smith, to No. 607 (County of Durham) (F.) Squadron, Usworth, 17.12.37. J. J. Watts, to No. 7 F.T.S., Peterborough, 13.12.37. R. H. Hobbs, to No. 228 (G.R.) Squadron, Pembroke Dock, 5.12.37. E. F. Porter, to Special Duty List; whilst on interchange duty with the Royal Australian Air Force, 4.12.37. I. V. Hue-Williams, to School of Army Co-operation, Old Sarum, 14.12.37. J. A. P. Owen, to R.A.F. Station, Bircham Newton, 18.12.37. T. U. Rolfe, to R.A.F. Station, Tangmere, 18.12.37. H. R. A. Edwards, to C.F.S., Upavon, 18.12.37. P. W. Bale, to No. 2 F.T.S., Brize Norton, 18.12.37. A. T. D. Sanders, to No. 3 F.T.S., South Cerney, 18.12.37. L. B. B. King, to No. 9 F.T.S., Hullavington, 18.12.37. R. C. Jonas, to No. 29 (F.) Squadron, Debden, 15.12.37. W. W. Stainthorpe, to R.A.F. College, Cranwell, 10.12.37. M. Hastings, to H.Q., No. 26 (Training) Group, Hendon, 18.12.37. F. E. H. Cooper, to No. 8 F.T.S., Montrose, 13.12.37.

Equipment Branch

Flight Lieutenants.—G. Blinman, to H.Q., R.A.F., Mediterranean, Malta, 2.12.37. B. S. Cartmel, to H.Q., R.A.F., Middle East, Cairo, 1.12.37.

Accountant Branch

Squadron Leader.—R. G. Dyer, to H.Q., Fighter Command, Stanmore; for Accountant Duties, 14.12.37.

Medical Branch

Wing Commander.—G. P. O'Connell, to No. 1 F.T.S., Leuchars; for duty as Medical Officer, 20.12.37.

Flight Lieutenants.—O. M. Fraser, to School of Naval Co-operation, Ford, 21.12.37. T. D. L. Bolan, to R.A.F. Station, Mildenhall, 20.12.37.

Chaplains Branch

Revd. E. W. Robotham, to R.A.F. Station, Halton; for duty as Chaplain (C. of E.), 6.12.37. Revd. T. D. Barr, to Home Aircraft Depot, Henlow; for duty as Chaplain (Presbyterian), 14.12.37.

Owing to the greatly increased length of these lists as a result of R.A.F. expansion, ranks are confined to those of Flight Lieutenant and above.

FOREIGN SERVICE NEWS

Assisted Take-off

RECALLING the work done at Farnborough some years ago, the climax of which was the catapulting of a Vickers Virginia heavy bomber, experiments are now being conducted at Langley Field, Virginia, U.S.A., with the launching of heavy machines under "field service" conditions. An attempt is being made to fit a catapult on a turntable for any wind direction.

The main difficulty experienced is that of power. For example, a machine weighing 60,000 lb. requires 3,250 h.p. Efforts are being made at Langley Field to discover a method demanding less power.

The Fastest Fighter

IT seems that the "hotted-up" Messerschmitt single-seater fighter which lately averaged 379.65 m.p.h. over a 3 km. course (flown six times in each direction) is designated the Me.113R.

Judging from the sole photograph which has appeared the machine is a direct development of the Me.109 as issued as standard equipment to the German Air Force. The engine was a Daimler Benz DB600 specially boosted to give, according to French authorities, about 1,500 h.p. The airscrew was the "Heddernheimer Kupferwerke" electrically controlled v.p. type.

AIRPORT TRENDS

The way in which inevitable expansions tend to spoil the effect of the original layout scheme is seen at Heston. The big service hangar, for instance, seen at the far end, overshadows the administration group. It may be expected that within the next year or two the entire airport will be redesigned and new buildings erected on the northern boundary.

NOWADAYS it is the fashion for those concerned with the financial side of airport development to complain bitterly, and perhaps rightly, that the specifications in the matter of size which were laid down by the Air Ministry many years ago are entirely inadequate. They ask, in fact, whether it is any use planning an aerodrome for to-day's requirements concerning take-off and landing runs when in five years' time transport aeroplanes may be demanding a maximum run which is five hundred yards or more greater than that expected to-day. As it is, these runs and obstruction arrangements are rather worse than a joke in very poor taste to municipal authorities whose only possible site may already be a most valuable one.

It would seem that aircraft designers will need to set about the business of producing machines which are fast enough for all normal purposes, yet which have a short take-off run and a steep ensuing climb. Another alternative is to devise an undercarriage or special take-off arrangements which will permit the use of a very long one-way area the layout of which might not be much more of a task than that of building a first-class arterial road.

All of which is looking into the future rather than seeing the situation as it is at this particular moment.

It is obviously difficult to deal adequately with all the many problems which confront the individual or committee which is considering immediate ways and means. The problems are for the architect, the surveyor, the layout experts, and others who are now specialising in them. The most that can be done in a short article is to consider a few of the more interesting and important ideas which have been put forward during the last year or two.

The primary need, of course, is to plan, finances permitting, as far into the future as possible. This does not mean simply the allowance of vast areas for development in due course and the prohibition of buildings above a certain height within specified areas, but also the design of airport buildings so that at the worst they can be extended almost indefinitely whilst still retaining the original layout plan.

Of the many aerodromes which were manufactured in the comparatively early days, some have since proved inadequate in area and others cramped in essential accommodation. In at least one case it has been found necessary to start work on an entirely new aerodrome because the original one, excellent though it was at the time when it was built, cannot be extended.

Some Tendencies in Design : Planning of Landing Areas and Buildings for the Future

A European runway layout—that at Bromma, Stockholm, where the landing area has virtually been blasted out of the solid rock. The position of the terminal building and hangar in relation to the runway system is noteworthy.

It is not necessary to point out that the people behind any aerodrome project must have a very clear idea of the nature and the volume of the traffic which they expect to see. The modern airline operator expects to be able to plan his schedules to a winter and summer and to an almost day-and-night time-table, and if transport machines are to be attracted or expected all kinds of lighting material and so forth must be installed. The Air Ministry is responsible only for the radio equipment, which is put down where the need is most obvious, and for the supply of control officers in the same conditions.

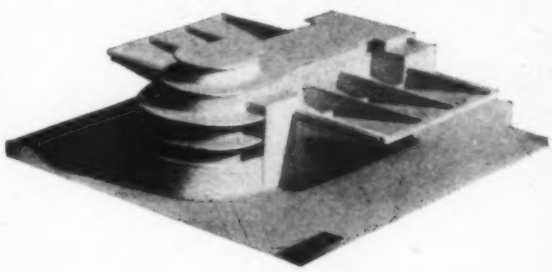
A glance at the illustrations and descriptions of some of the more modern designs which will be found in the centre pages will show that no two architects have the same ideas. A notable tendency nowadays, for instance, is to provide a covered area on what is at present known, for some good historical reason, as the tarmac, so that both the machine and its freight, live or otherwise, is under cover for unloading and minor attentions. In this connection the sliding canopies, such as were designed for Gatwick, provide a useful alternative, though the little tunnels are often of necessity rather cramped in size and a machine, which has no reverse gear, cannot always be taxied accurately to the correct spot.

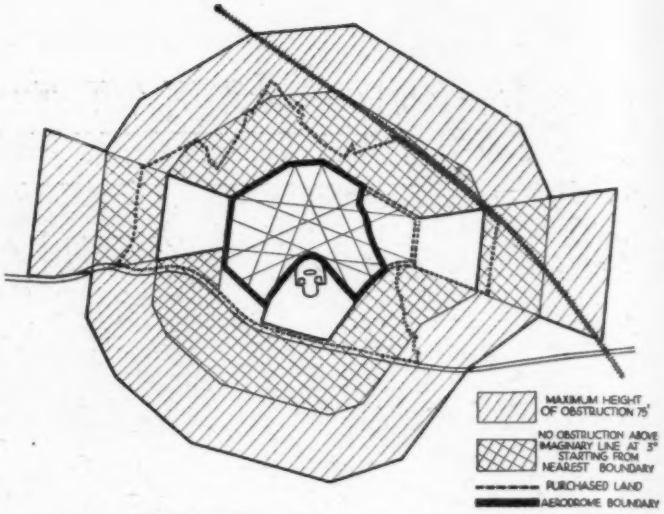
At Tempelhof, Berlin, an immense cantilever will provide simultaneous covering space for the largest possible fleet of transport machines, but experience will show, in this case, exactly how far passengers will walk on their own feet without making complaints. Probably some kind of local transport will be provided for them as the number of arrivals and departures become so large in future years that the entire covered area is in use. The same idea, on a smaller scale, will probably be seen at Birmingham's new airport, with additional canopies for the use of passengers from machines which cannot be accommodated under them.

Another point which has not so far been very seriously considered in this country is the provision of spectatorial facilities. These have been an important feature of a number of airports on the Continent, where the authorities have fully realised that the interested spectator of to-day is the fare-paying air traveller of to-morrow. It is obviously necessary to provide them with comfortable winter and summer terraces whence a complete view of the airport is obtainable. Such accommodation is only likely to be necessary at larger terminal airports where there is any volume of traffic to provide the necessary spectacle, though even at some of our less-used aerodromes the public appears to be glad to come along almost for the sole pleasure of taking tea in the fresh air.

Another original feature of Berlin's airport is the fact that the administration buildings, hangars and workshops form one complete structural unit. One of the least pleasing features of the average airport is the appearance of usefully enormous, but sometimes extremely ugly, erections scattered around a terminal building which may itself be quite a handsome object. If, however, the buildings are to be designed as one complete unit it is obvious

A model of the projected Birmingham airport building, which has been designed by Norman and Dawbarn. The canopy system is a feature of many modern layouts.




MAXIMUM HEIGHT OF OBSTRUCTION 75'
NO OBSTRUCTION ABOVE IMAGINARY LINE AT 3° STARTING FROM NEAREST BOUNDARY
PURCHASED LAND
AERODROME BOUNDARY

How the approaches and possible extensions have been planned at the Birmingham airport. The central area is that now being developed for the initial scheme.

that the conception must be full-scale and futuristic; otherwise the same displeasing sheds may need to reappear after ten years or so. Incidentally, it is worth remembering that the largest transports of to-day have wing spans of 150ft. or more and that such machines are certainly not likely to be reduced in span as the years go by.

Unfortunately, since economy must be considered, practically all the aerodrome buildings in this country must be started on a small scale and designed so that extensions can be made if and when necessary. This fact, except in the case of a few centres which must obviously become more and more important, militates against architectural beauty, since only a building designed as a whole can be really pleasing to the eye. At the moment the designers of the buildings at one or two of the more important centres have the most magnificent opportunities for the exercise of design skill and foresight.

A design has recently been suggested in which the work is carried out in a series of separate schemes; one for the present day, another to be put in action in five years' time, and so forth. It would seem that there is nothing impossible or even difficult about a planning system on these lines, and the relative position of such basic items as the control office can remain unaltered in the course of the extensions. This particular plan envisages the use of light steel framework carrying largely standardised and reasonably mobile units. At any rate, the fact that the airport buildings must expand in due course cannot be given too much consideration.

Over here it is customary to construct the landing area itself of turf, though elsewhere, and particularly in America, surfaced runways are the order of the day. The steadily increasing weight and take-off speed of transport machines will probably mean eventually that the landing areas at our larger terminals will need to be modified to take at least one major runway.

Various runway schemes have been devised to provide the maximum variety in take-off and landing direction with the minimum amount of necessary surfacing.

In the original plans for the construction of Birmingham's airport at Elmdon the extension schemes were very clearly worked out. Apart from that for the initial landing area, which should by now be almost ready, and its extension under the "master scheme," sections of the immediately surrounding country were designed to be left entirely without obstruction of any kind, and other concentric areas covering a very wide acreage were to be kept clear of obstructions above a certain height according to the position of the aerodrome boundary. These areas are diagrammatically shown in the illustration on this page. In addition, space was left for the further completion of the airport buildings under the aforementioned "master scheme." A sufficient quantity of land was purchased early in the proceedings in order that there should be no hitch in the development of the airport. By such means have the Birmingham authorities prepared for the future.

The interesting route and notice board which is installed at Rangoon airport. Only a part of this board is shown, but the route diagram, which extends on each side of the illustrated section, gives all the essential information for the aerodromes and landing grounds across India and Burma. Notices affecting each of these are pinned in their appropriate cases and the scheme may be extended or modified as occasion demands.

AIRPORT EQUIPMENT

A Review of Current Productions : Landing-ground and Building Construction

Lighting : Radio : Refuelling and Service : Workshop Equipment : Marine-airport Craft.

Aerodrome Construction and Maintenance

Bradshaw Bros. (Contractors), Ltd., Blackbird Road, Leicester, state that they have completed no fewer than twenty large aerodromes during the past two years.

In addition to constructional work of this kind they are experts in the improvement and drainage of existing aerodromes, and have recently perfected a gravel-filled mole drainage system (see illustration) which is proving very successful. They have also invented a piercing machine for cutting "plugs" out of the ground. The holes thus made, 9in. deep, are filled with sand or ashes, thus rendering badly drained aerodromes usable at short notice. It is stated that at a certain Midland aerodrome, which might otherwise be flooded, this process has been so successfully applied that the heaviest bombers are taking off under all weather conditions.

Carr, Ltd., J. B., Tettenhall, Staffs.—All phases of aerodrome preparation, from the choice of sites to final levelling and seeding, are carried out by this firm.

Among recent contracts is one for A.S.T., Ltd., at Ansty, which involved drastic clearance of trees and filling of ponds and ditches; the preparation of Leicester Municipal Airport, including layout of roads and sewerage systems; and the preparation of Gloucester and Cheltenham Joint Airport.

An outstanding aspect of the firm's activities is the mole drainage system.

The En-Tout-Cas Co., Ltd., Syston, Leicester, have, during the past year, been extremely busy on aerodrome and airport construction. They have completed the first portion of the new Manchester Airport contract at Ringway, and now have a second contract there, extending the initial area of approximately 200 acres by a further 50 acres.

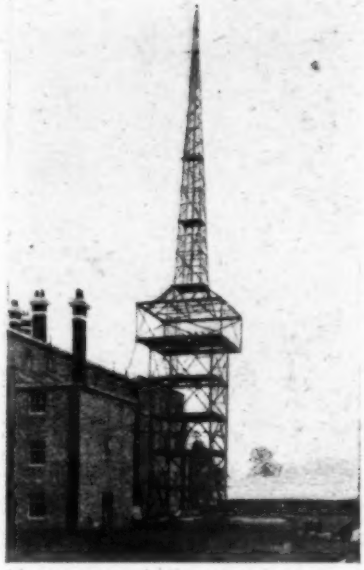
En-Tout-Cas have carried out the construction of aerodromes for corporations, private persons and the Air Ministry. In particular, they have extended Desford Aerodrome (belonging to Reid and Sigrist, Ltd.), by 80 acres, and for the past five months have been erecting extensive new buildings on that aerodrome; these comprise a hangar 200ft. long by 70ft. wide, large new clubhouse, machine-gun range, etc. In addition, they have laid out a squash rackets court and two hard tennis courts at this aerodrome.

It will thus be seen that En-Tout-Cas are not only in a position to undertake landing-ground construction, but also erect buildings for operational purposes and carry out the construction of such recreational facilities as squash and tennis courts and swimming baths.

Green and Sons, Ltd., Thomas, New Surrey Works, Southwark Street, London, S.E.1.—This old-established firm of lawn mower manufacturers includes in its range of machines several types of triple, quintuple, and septuple gang mowers, particularly suitable for aerodrome maintenance, where quick and efficient mowing is a primary consideration. The firm has fulfilled a number of Air Ministry contracts.

Hunters of Chester (James Hunter, Ltd.), Chester, aerodrome constructors, initiated the process known as "Hunterising," which produces level, solidly compact, self-draining surfaces.

They possess a staff of specially trained and highly skilled workmen and a battery of



148ft. meteorological tower by Wright, Anderson and Co., Ltd.

soil-excavating, levelling, grading and transporting implements, which, it is stated, is notable for perfection of performance and magnitude of scope.

Lloyds and Co. (Letchworth), Ltd., Pennsylvania Works, Letchworth, Herts.—The problem of keeping down grass on aerodromes is not easy of solution. Grazing by live stock has obvious disadvantages; the average farm mower is slow, and usually cuts only a 5ft. width; and the golf-course gang mower is not usually designed for such strenuous work. What is wanted is a mower of the gang type, but of robust construction, unchokable, capable of being drawn by a tractor and having an effectual cutting width of sixteen feet or more.

Such a machine, specially designed for aerodrome work, has recently been supplied to the Westland Aircraft Company by Lloyds and Co., who claim to be pioneers

"Mole drainage"—a photograph which explains the term. The "burrow" is afterwards filled with pebbles (Bradshaw Bros.).

in the construction of gang mowers. It has no iron castings to fracture, neither are there any thin steel plates to warp and bend. The chassis is built up on two side plates of heavy steel castings which are machined true on all faces, as are also the gear covers, so that an efficient seal against dust and dirt is assured. The steel gear wheels are of accurate profile, and run in grease. The cutting cylinders are sturdily built with double riveted blades and are fitted with anti-choke plates. The road wheels are of heavy malleable pattern, with deeply fluted non-skid rims.

Pugh, Ltd., Chas. H., Whitworth Works, Tilton Road, Birmingham, 9, are makers of the well-known "Atco" motor lawn mowers and power-driven scythes. These are particularly useful for aerodrome mowing in the neighbourhood of clubhouses, etc., where the presence of heavier apparatus, as used to mow the landing ground, would be inconvenient.

Ransomes, Sims and Jefferies, Ltd., Ipswich, Suffolk, have had considerable experience with mowers for cutting aerodromes, and they offer gang mowers with 3, 5, 7, 9 or 11 units. The largest combination has a cutting width of 25ft. and will deal with as much as 80 or 90 acres in a day.

Ransomes also manufacture a number of very useful machines for aerodrome work, including a rotary scraper for levelling sites, a mole drainer, which is equally suitable for laying underground cables without digging and without disturbing the ground surface, and special cultivators for turf cultivation.

B. Sunley and Co., Ltd., Sunley's Island, Great West Road, Brentford, Middlesex.—Sunley's have a specialised organisation equipped for the levelling, preparation and extension of civil and military aerodromes.

A contract is carried through in the quickest possible time by the use of large caterpillar tractors and Le Tourneau equipment, which are but part of the large fleet of over eighty tractors which are always in use and which Sunley's have available for hire.

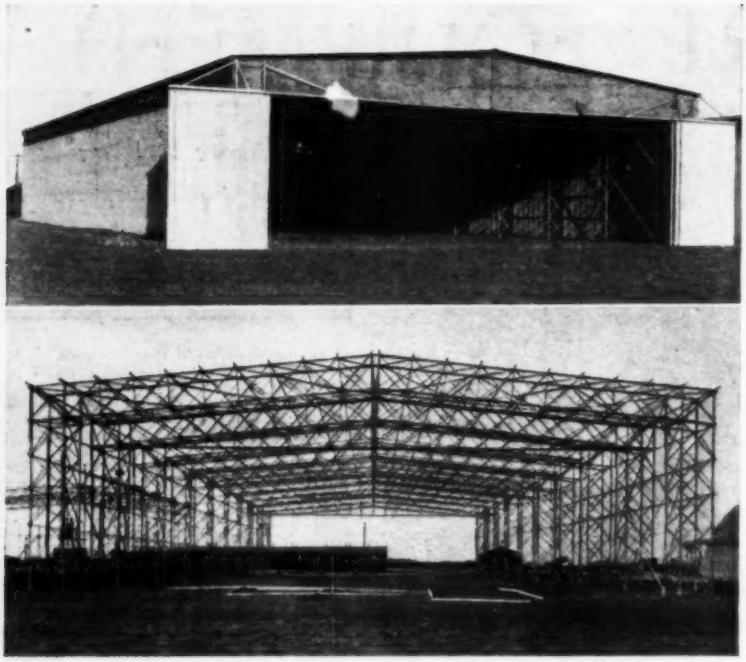
Sutton and Sons, Ltd., Reading, having studied every form of turf production for nearly a century, are in an excellent position to ensure satisfactory seeding of any aerodrome.

Webb and Sons, Ltd., Edward, Stourbridge.—Experts on the subject of seeding for grass, Edward Webb have closely studied the subject of aerodrome preparation, and have been responsible for the seeding of several important aerodromes. the grass usually advised is of a particularly tough-rooted nature.

Hangars, Buildings and Doors

Boulton and Paul, Ltd., Norwich.—Old-established specialists in constructional steelwork, Boulton and Paul have been responsible for the erection of numerous aircraft hangars and factories at home and abroad.

A glance at their beautifully illustrated catalogue shows that to their credit stand big buildings that are "household words" in the aviation industry, e.g., the Airwork service hangar at Heston, the Saunders-Roe erecting shop at Cowes, and the open-jet wind tunnel at Farnborough, yet they also undertake the construction of small, simple and inexpensive airport buildings and clubhouses.



A Callender-Hamilton unit-construction hangar for the Air Ministry, before and after completion. Note the unobstructed door opening.

Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C.4.—The Air Ministry has had eight of the Callender-Hamilton unit-construction hangars erected on various sites, and the necessary steelwork is now available on a commercial basis. The famous cable and pylon firm have placed the hangar on the market in conjunction with Painter Bros., Ltd., of Hereford, after exhaustive tests.

Some of the claims are: Lightness with low cost, standardisation of parts, ease of transport and erection, all connections by bolts, and all parts protected against corrosion by special hot-dip galvanising (as used on "grid" towers) after fabrication. The sliding doors system incorporated gives maximum clear opening, the foundations may or may not be set in concrete, and the roof, sides and doors can be covered with any form of material.

The steel framework consists of a series of box girder ribs comprising vertical stanchions supporting flat pitch roof girders of similar cross section. These girders give normal clear height of 25 feet on a span approximately 100 feet. Any length of hangar may, of course, be built by adding bays as required. The manufacturers, Painter Bros., are specialists in the fabrication and galvanising of light steel structures.

Cleveland Bridge and Engineering Co., Ltd., Darlington.—A firm which is responsible for such engineering masterpieces as the Lower Zambesi Bridge can have little to learn about large spans in steel; thus it may be rightly assumed that, apart from the example of the many Service hangars which they have already erected, the Cleveland Bridge Company can fulfil all requirements in airport hangar construction.

They design, construct and erect hangars from 50ft. by 50ft. upwards, and these are fitted with easily handled roller-bearing doors.

Diagrid Structures, Ltd., Horseferry House, Westminster, London, S.W.1.—The "Diagrid" system of construction has advantages of particular value for aircraft hangars. Briefly, "Diagrid" floors or roofs consist of two interlacing sets of diagonal beams, giving a structure of great strength and rigidity. Very large spans can be economically carried out, and the wide door openings required can be arranged without heavy girders.

Eclair Doors, Priory Works, Shirley, Birmingham.—Orders for "Eclair" hangar and factory doors are now so large that Hawes and Snow, Ltd., have been forced to form a separate company under the above heading. While, twelve months ago, they thought that a door 40ft. wide in one piece was something exceptional, they have since fitted numerous doors 150ft. wide in one piece, and have now got out the designs for a single door 300ft. wide in one piece.

Educational Supply Association, Ltd., Esavian House, 181, High Holborn, London, W.C.1.—Whilst the general principles of the Esavian folding and sliding doors, hangar and works doors remain the same, detailed improvements and developments are constantly taking place. A very important new design allows the doors to be opened from either end as well as from the middle. The importance of this will be realised especially by the heating engineer, as no longer is it necessary to open all one side to get an aeroplane out from the end.

Top and bottom movements on the sliding upright can be lubricated by means of group lubrication, with the grease nipples mounted on a battery plate, conveniently located on the sliding upright for easy operations. Oil-less bushes are used for all important bearings not fed by the group lubrication. The weight of the doors is carried on a bottom movement running on a "T" track, and thus there is no weight carried by the structure of the building—a great point in the economy of building costs.

The electrical apparatus for opening and closing the doors can be arranged in such a way as to meet the requirements of the Home Office, and can be used without danger of sparking on doors enclosing "dope" shops and other premises where highly inflammable material is stored. Where fitted, the electrical winding gear will open or close doors 200ft. wide in under 60 seconds.

En-Tout Cas Co., Ltd., Aerodrome buildings.—See under Aerodrome preparation.

Gibson and Co., Ltd., Arthur L., Radnor Works, Strawberry Vale, Twickenham.—Kinnear patent steel rolling shutters are particularly suitable for inclusion in a variety of aerodrome buildings.

Sufficient testimony to their reliability and efficiency under arduous conditions is the fact that they are used for the hangars of all aircraft carriers of the Fleet Air Arm, as well as for the deck hangars of aircraft-carrying cruisers.

Horseley Bridge and Thos. Piggott, Ltd., Tipton, Staffs.—This firm's "Lamella" roofing construction provides a clear and uninterrupted floor space. Provision is made for future extension and unit construction lends itself to easy transport and speedy erection, mainly by unskilled labour.

The shape of the pressed-steel section is developed to obtain the maximum rigidity. The whole structure is built on the sound principle of the arch, and its strength is stated to be exceptional for the weight of steel employed.

The units are light in weight and nest together compactly for ease and economy in transport.

Law, Ltd., A. and A. J., 132, Kingston Road, Merton, London, S.W.19.—This firm specialise in steel- and timber-framed hangars and workshops, with brick, asbestos or corrugated iron sidewalls and asbestos or corrugated iron roofing. Their specially designed hangar doors are claimed to be particularly easy to operate and are of pleasing appearance.

For extra-large span hangars the firm have a copyright design (type LS), as supplied to Gravesend and Reading aerodromes.

Lindsay-Neale Aviation Co.: Hangars.—See under Fire Fighting and Crash Equipment.

Lysaght, Ltd., John, Bristol, specialists in constructional steelwork, have erected a large number of steel structures for the housing and manufacture of aircraft. They were responsible for considerable extensions at the Bristol Aeroplane Company's works.

Nissen Buildings, Ltd., Rye House, Hoddesdon, Herts.—The name of Nissen is one of well-remembered association where metal buildings are concerned, and the firm have had very long experience of the adaptation of their distinctive system to airport needs.

Their latest departure is the design of air-raid protection buildings of many types.

Wright, Anderson and Co., Ltd., Gateshead-on-Tyne.—Experts in constructional steelwork, this company has erected both large and small steel-framed buildings for a great variety of purposes at home and abroad.

They are well fitted to undertake hangar construction, and their catalogue illustrates a number of such structures—one, with 700 tons of steelwork, has a 160ft. clear span and is 40ft. high to the eaves; another is part of a group of hangars totalling 3,500 tons of steelwork. Among recent contracts were hangars for the Newcastle Municipal Airport, Woolsington.

A Lloyds gang mower at work on the Westland aerodrome, Yeovil.

Aerodrome Lighting Equipment, Wind Indicators, Etc.

Airco, Ltd., 3, St. James's Square, London, S.W.1.—Among the multitude of aviation accessories and equipment for which Airco are agents, may be mentioned Tilley portable floodlights. A battery of powerful paraffin vapour incandescent-mantle projector lamps is mounted on a wheeled trolley. Equipment of this type is particularly useful for lighting small or temporary landing grounds where electricity is not available.

Chance Bros. and Co., Ltd., Lighthouse Works, Smethwick, Birmingham.—Of outstanding interest in the wide range of airport lighting equipment made by this firm is the "Hexagon" floodlight. It is of the reflector type and is split up into six or more units, each unit comprising a trough-type glass reflector, in front of which is

Chance Bros. 24in. revolving reflector beacon of over 1,000,000 c.p., as supplied to Jersey Airport.

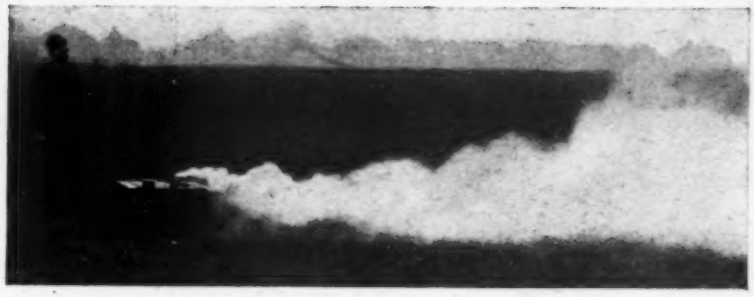
mounted a line-filament horizontal lamp, generally of 1-kW.

Each of these units is mounted in a tubular framework to form a unified structure, and the fact that the complete assembly can be split up electrically into three 2-kW units is advantageous when connecting the floodlight to a 3-phase supply.

The assembly is enclosed in a hexagonal housing, which is built up of non-metallic oil-impregnated sheets of asbestos composition, which are completely weatherproof, and at the same time light and of great strength. These sheets are built up on a light steel framework.

The 6-kW hexagonal floodlight, it is stated, has a beam candle-power of 1.2 millions, and is capable of illuminating a rectangle of at least 1,500ft. × 750ft. with a minimum illumination of 0.2 ft.-candles, assuming no atmospheric absorption.

Other Chance Bros. aerodrome equipment, well known and widely used, includes self-contained mobile floodlights, low-voltage "knock-over" boundary lights, obstruction



G.A.L. electric smoke trail in operation. In actual use it is sunk level with the ground (General Aircraft Ltd.).

lights, revolving reflector beacons, neon beacons, and lighting control desks. An ingenious feature of certain types of beacon is an automatic lamp change-over that operates should a lamp fail, a "replacement required" warning sounding at the same time.

Clarke, Chapman and Co., Ltd., Gateshead, Co. Durham, manufacture aerodrome and airway lighting equipment such as beacons, boundary and obstruction lights, illuminated wind tees, aerodrome floodlights, ceiling projectors, wind velocity indicators and strip-type landing lights.

In addition, they produce all classes of searchlights and low- and high-intensity projector lamps of the semi-automatic and fully-automatic type, the latter embodying their patent light control.

This firm also produce all classes of generating sets, switchboards, motors and control equipment; they have recently marketed a special standby generating equipment which can be arranged for automatic starting, either by light-sensitive devices, automatic control device or by failure of a mains supply. This set can be run for long periods unattended.

General Aircraft, Ltd., London Air Park, Feltham, Middlesex.—A sensitive indicator that indicates wind direction just where the pilot wishes to know it, i.e., on the surface of the aerodrome, is a speciality of General Aircraft, Ltd., manufacturers of Monospar aircraft.

The G.A.L. smoke-trail wind indicator is made in two models. Both depend for their effectiveness on the continuous production of a thin but dense plume of white oil vapour. In one case the oil-vaporising element is heated by mains electricity (which is automatically switched off when the 180-hours oil supply is exhausted); in the other it is operated by a petrol burner.

In both types economy of operation and a minimum of maintenance are features. The apparatus is installed in a pit in any desired part of the landing area, and covered by a flush-fitting lid stressed to take a 10-ton load. The smoke trail can be illuminated at night.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Testimony to the efficiency of G.E.C. airport lighting equipment (which includes floodlights, route and identification beacons, boundary and obstruction lights and wind indicators) is given by the fact that it has been installed on the 2,400-mile Empire air route across India from Karachi to Rangoon.

Types of floodlight on the route vary from 9-kW 9-lamp floods to a 9-kW 3-lamp combined floodlight-beacon. The rotating beacons installed at Karachi, Cawnpore and Allahabad are of a new type, employing a 50-volt 1,500-watt Osram lamp in conjunction with a special reflector. These give a main beam with a horizontal ground spread of about 12 degrees with a vertical spread of 3 degrees. The beam is visible at a flying height of 3,000 feet, and aircraft can receive signals 35 to 40 miles away. On top of these floods is a red identification light arranged for morse flashing.

Wind velocity indicators are installed and connected to illuminated signs which record correct night readings of velocities.

Special lighting control desks have been installed in the control towers of certain of the aerodromes.

At aerodromes where there is no electric supply duplicate generating sets have been installed to provide current.

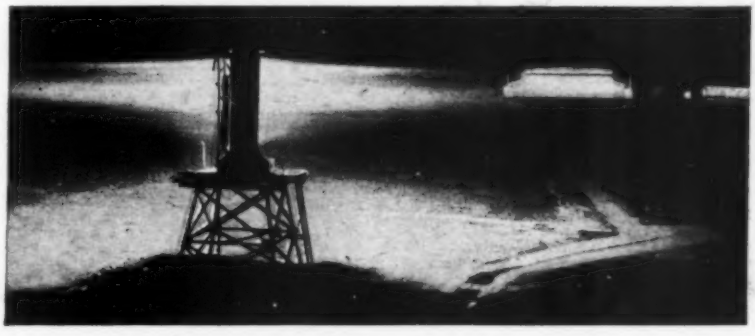
Martin-Baker Aircraft Co., Ltd., Higher Denham, Bucks.—Of 50ft. length and 30ft. span, the Martin-Baker T-type aerodrome wind indicator is stated to be easily visible by day or night from 6,000ft.

Of all-steel construction, yellow painted, the indicator revolves on Timken roller bearings and will react to a 5 m.p.h. wind. A patent device ensures return to any predetermined position in windless conditions. At night, the "T" is illuminated by twenty 40-watt lamps.

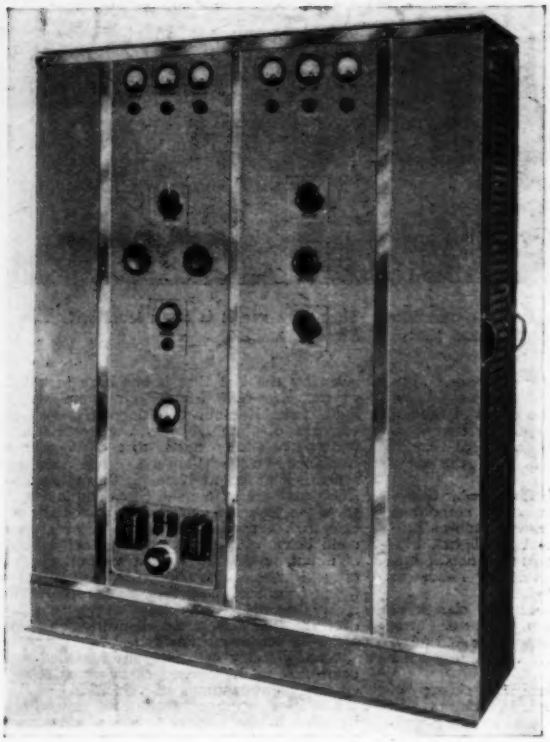
Radio and Traffic Control Equipment

Aldis Bros., Sarehole Road, Sparkhill, Birmingham, are makers of the Aldis daylight signalling lamp, which is a standard item of control-tower equipment at most airports.

Marconi's Wireless Telegraph Co., Ltd., Marconi Offices, Electra House, Victoria Embankment, London, W.C.2, have specialised in wireless equipments for aerodromes and aircraft since the earliest application of radio to air and ground communication. Marconi aerodrome wireless



G.E.C. 9 kW. floodlight at Dum-Dum Aerodrome, Calcutta.



(Above)
A familiar sight at aerodromes—a National Benzole tanker, which can pump fuel to a height of 35ft.

(Left)
Marconi ultra-short-wave aircraft radio beacon.

equipment is installed in all parts of the world, and transmitting and receiving sets are available for all aerodrome requirements.

Marconi-Adcock D/F. receivers can be supplied for use on either medium or short wavelengths, and are now established equipments on the principal air routes—internal, trans-Continental and trans-Atlantic.

The latest type of Marconi aerodrome equipment, and one which is becoming increasingly necessary as air traffic becomes more exacting, is the aircraft beacon, for use on either medium or ultra-short waves. The medium-wave approach beacon, such as that installed at the Liverpool Airport, has the advantage that it does not require anything more than the normal medium-wave wireless receiver to be carried in the aircraft.

The ultra-short wave beacon does require additional receiving equipment, but is preferred in areas where the medium-wave bands are fully occupied by other services. Radiation is fully concentrated in the direction of the approach path to be followed by the aircraft. This not only eliminates radiation in unwanted directions with consequent economy in prime and maintenance costs, but it greatly reduces the possibility of mutual interference between neighbouring beacons.

Radio Transmission Equipment, Ltd., 45, Nightingale Lane, London, S.W.12.—In the sphere of air traffic operation R.T.E. radio equipment is comprehensive. For instance, they have designed a high-grade transmitting installation which is especially suitable for giving pilots bearings and meteorological and other information.

The transmitter, Type TGM.100, is adapted for telephony, C.W. and M.C.W. telegraphy, has a waverange adjustable between 750 and 1,380 metres, and consists of master oscillator, amplifier and modulator stages.

Again, approach and landing beacon transmitters have been designed to operate on both medium and ultra-short wavelengths. The radiated field pattern of the R.T.E. ultra-short wave beacon effectively illustrates the efficiency of such systems when approached in the correct manner. This radiation is concentrated so that the greater section of the radiation lies on the course line. It is apparent that for a predetermined field strength the output power and running costs are greatly reduced.

Other types of equipment manufactured include aircraft and aerodrome receivers and transmitters, portable transmitters, and, in fact, radio equipment to meet all demands.

Standard Telephones and Cables, Ltd., Connaught House, Aldwych, London, W.C.2, produce an extraordinarily wide range of ground transmitting and receiving apparatus, apart from aircraft equipment.

Transmitters are as follows: Short-wave group—R.5, two types, 500 watts and 1,000 watts, 16-120 metres; R.12, 500 watts, 16-120 metres; R.13, 1,000 watts, 16-120 metres; R.16, 2/2½ kW, 16-100 metres (all the foregoing offer six predetermined crystal-controlled frequencies); and R.15, 16-100 metres with high-stability oscillator, 2½ kW. All the foregoing output figures are for C.W. telegraphy; M.C.W. and telephony are also available in each equipment.

Type R.4 (250 watts) offers short and medium waveranges from 40 to 1,200 metres; type R.10 (1 kW), covers 500-3,000 metres; and type R.11 has a similar range but 2-kW output.

There are six receivers to meet all requirements on long, medium and short wavelengths and, lastly, two types of Standard-Adcock D/F. equipment, which may also be used for non-directional reception on long and short waves.

The Y.S.C., Ltd., 13, Thavies Inn, Holborn Circus, London, E.C.1.—Used extensively at aerodromes all over the country, Very signal cartridges and 16oz. friction-ignition rockets are supplied by this company.

Their experience in the production of Holt wing-tip flares since 1914 gives them the facilities for producing these landing-ground pyrotechnics with the same care that is essential for the flare; further, they appreciate the importance of packing with a view to proper storage over long periods without deterioration.

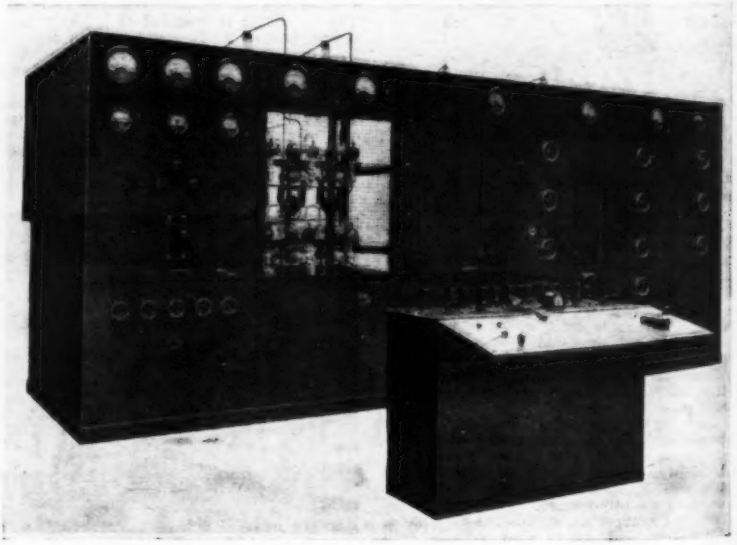
Refuelling and Aircraft Servicing Equipment

Anglo-American Oil Co., Ltd., 36, Queen Anne's Gate, London, S.W.1.—One of the most vital factors in the success of a fuel—apart from quality—is its world-wide distribution. Stanavo is available at airports all over the world. In addition to Stanavo aviation fuels there are Stanavo engine oil and other lubricants.

Stanavo can supply 100-octane spirit in commercial quantities to aircraft manufacturers and airline operators.

Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester, makers of Exide aircraft batteries, offer a ground starting unit which can easily be wheeled to an aeroplane no matter in which position of the aerodrome it may be.

Normally, the trolley carries a battery in two sections, nominally of 12 volts each, which can be connected in series or in parallel to suit the starting motor of the particular engine concerned, the changeover from 12 to 24 volts being made by means of a



R.T.E. airport transmitter Type TGM.100, with 750-1,380 m. waverange.

simple link-switch with clamping device to ensure good electrical contact to carry the very heavy current involved. The trolley is used by the Bristol Aeroplane Co. for ground starting of aero engines.

Germ Lubricants, Ltd., City-Gate House, Finsbury Square, London, E.C.2.—"Germ" oils are now available at all leading aerodromes in Great Britain and Ireland, as well as at an ever-increasing number abroad, and the photograph on page 80 depicts two of the neat ten-gallon drum portable equipments supplied by the company at an extremely modest price. The pouring of oil from barrels or pumping from bulk into fixed containers is completely eliminated, as the actual drum in which the oil is delivered can be dropped into the trolley in something under five minutes. Delivery is then made direct into the engine through a semi-rotary pump.

The company run a Gipsy Six Miles Falcon, which is well known both at home and abroad.

National Benzole Co., Ltd., Wellington House, Buckingham Gate, London, S.W.1. The facilities for the supply of motor spirit at airports have become increasingly important with the larger volume of air traffic, and the problem has been tackled in several ways. The National Benzole Company were among the first to introduce mobile fuelling tankers, and to-day these vehicles are a familiar sight at important airports all over the country.

These tankers, mounted on six-wheeled chassis and with a capacity of 800 gallons of spirit, can be swiftly driven to any part of a flying field to refuel any type of machine. High-powered electric pumps are used and a meter checks off the gallons in the same manner as an ordinary service station pump.

These fuelling tankers are popular at airports not only because of their time-saving in filling up, but because of the qualities of the home-produced benzole spirit they supply, widely appreciated by flying people.

Peto and Radford, 50, Grosvenor Gardens, London, S.W.1.—Makers of aircraft batteries, this firm also offers a range of heavy-duty ground-starting batteries.

Their most useful application is when combined in the "Dagenite" battery trolley, an item of equipment in which every point of design has been carefully studied.

The two six-volt batteries normally supplied in the truck will give as many as 489 consecutive 100 amp. starting discharges at one-minute intervals. The increasing popularity of 24-volt aircraft electrical installations has also been anticipated, and two 12-volt batteries can be supplied to fit the trolley.

Pillin, Ltd., John B., Beckenham, Kent.—The Pillin range of oil dispensing equipment contains numerous units suitable for aerodrome use.

One unit specially designed for this purpose is the transportable aerodrome oil dispenser fitted with "Victory Precision" meters. This unit operates from either 25- or 58-gallon containers at the rate of 1 to 3 gallons per minute.

The Pillin range also includes electric and air operated oil pumps delivering from underground storage tanks.

Shell-Mex and B.P., Ltd., Shell-Mex House, London, W.C.2.—Until comparatively recently the method of delivering lubricating oil to large airliners was by means of cans and funnels. To overcome such difficulties, the experimental staff of Shell-Mex and B.P. designed the "Meta" pump unit, which, due to its extreme mobility, can be operated entirely by one man.

It consists of a 50-gallon horizontal cylindrical tank mounted on to pneumatic-tyred wheels, and having a hand-pump, metering equipment, hose, etc. Rotation of the pump handle in one direction delivers oil direct to the aeroplane tank; rotation in the opposite direction, with the fixing of a self-filling attachment, enables the outfit to refill itself from a barrel of oil.

The speed of delivery varies according to the viscosity of the oil, but it is approximately three gallons per minute. Arrangements can also be made whereby the temperature of the oil can be raised by the employment of an electrical heater. Shell refuelling services, to be found on aerodromes all over the world, are too well known to need emphasis.

The new Castrol oil-dispensing unit, with B.O.T.-approved flowmeter.

Silent Gliding Doors, Ltd., 53, Archer Street, London, N.W.1.—Developed in the first place for partition doors in houses, offices, shops, etc., "Glidordor" sliding doors are now made in large sizes of the kind required for factory and aerodrome use.

The outstanding feature of these doors is a system whereby the leaves run on flanged wheels in a sunken grooved rail; between wheel and rail is a special rubber strip which not only covers the rail trough flush with the floor, but ensures absolutely silent sliding movement of the doors.

Tecalemit, Ltd., Great West Road, Brentford.—Equipment for aerodrome services covers a wide range. Apart from workshop and overhaul equipment, such as bulk oil filters for engine test beds, there are various kinds of aircraft refuelling apparatus.

Notably, there is a hose nozzle with an automatic cut-off which operates when the aeroplane tank is full and a gas seal which transfers vapour back to the tank from which fuel is being pumped.

There are also portable apparatus for receiving oil drained from sumps; portable refuelling pumps; engine oil and water heaters; and bulk petrol filters.

Thompson Bros. (Bilston), Ltd., Bilston, Staffs.—The original T.B. mobile refuelling unit was the 250-gallon type, designed some time ago and still supplied in a modernised form under the type-name of "Castle Bromwich" for aerodromes where the quantity of fuel to be dispensed is comparatively small.

Much larger is the Ford "Sussex" six-wheeler, with 700-gallon tank, power-driven pump, and a delivery of 70 galls./min. It is particularly suitable for airline work and is widely used on Continental airports.

Another popular T.B. unit is the mobile refuelling tender, which, powered by a Ford 8 engine, is particularly handy at flying training schools, as it is capable of refuelling twenty aircraft in 45 minutes. A 25-gallon oil tank, operated by compressed air, is the latest refinement.

Vacuum Oil Co., Ltd.—Facilities for obtaining the well-known grades of Aero Mobiloid, "Red Band" (winter) and "Green Band" (summer) are available at every airport and all the principal aerodromes in Great Britain.

Wakefield and Co., Ltd., C. C., Wakefield House, London, E.C.2.—Among this famous oil company's many items of equipment associated with the supply of oil for aircraft is a new portable dispensing unit (illustrated above), made in 28-gallon and 58-gallon sizes.

A hand-pump with a capacity of 3 gallons per minute supplies the oil via a "Victory Precision" meter, which is passed by the Board of Trade as giving correct and legal measure. A 6½in. diameter filler is provided with a large filter.

Zwicky, Ltd., Slough, Bucks.—Designers and constructors of aircraft refuelling units, and suppliers in large quantities to the Royal Air Force. Zwicky, Ltd., have recently perfected two new motor tenders, both of large fuel capacity. One is an airport refuelling tender, of handsome semi-streamlined design, and the other a Service unit.

In both cases a delivery of 150 galls./min. is possible; there are separate tanks for different octane values (multiple pumps prevent risk of adulteration), and the spirit is delivered close-filtered, de-aerated and recorded.

Fire-fighting and Crash Equipment

Auto Fire Protection, Ltd., 64, Victoria Street, London, S.W.1.—Outstanding in a most comprehensive range of crash and fire-fighting equipment is this firm's aerodrome tender, based on a Crossley 30/100-h.p. chassis specially adapted for rough ground.

The fire unit consists of an engine-driven "Airfoam" pump capable of delivering over 1,500 gallons of foam per minute, fed from a 500-gallon water tank and 50-gallon foam solution tank. There are connections for four hoses. The tender has accommodation for a crew of six and all necessary rescue equipment.

Among the lighter apparatus is a self-contained trailer unit with four-cylinder engine to pump foam (400 g.p.m.) or water (250 g.p.m.); a portable unit with small two-stroke engine pumping foam at 40/50 g.p.m.; and trailer units for pumping water alone.

In addition, there is a full range of extinguishers and crash equipment.

Bell's Asbestos and Engineering Supplies, Ltd., Slough.—Developed primarily for use at R.A.F. stations, Bell's asbestos crash rescue suits are equally practical for civil aerodromes.

Bell's, who are experts of long standing with regard to everything connected with asbestos, have also adapted this unique material to other fire-fighting ends—notably the provision of screens, rather like cricket bowling screens, intended for wheeling into position to isolate aircraft fires in hangars while other machines are removed.

Kidde Co., Ltd., Walter, Lux Works, Belvue Road, Northolt, Middlesex, are specialists in the use of carbon dioxide for fire extinguishing, flotation gear and other purposes. Their "Lux" fire-extinguishing equipment has been adopted by the aviation industry generally, and by the Royal Air Force, for crash tender work.

The Lindsay-Neale Aviation Co., 7-8, Norfolk Street, London, W.C.2.—Mr. R. Lindsay-Neale's seven years' experience of flying aircraft of all types (and as aviation manager for Selfridges, and with Brian Lewis and Co., Ltd., and in association with a well-known aeronautical consultancy) has enabled him to design and supply hangars, clubhouses and crash tenders to solve individual problems.

"L. and G." fire-extinguishers (for which the company are aviation concessionaires) and the Lindsay-Neale tenders (carrying crash and first-aid equipment) have been adopted by Northern and Scottish Airways, Ltd., Whitney Straight, Ltd., and aircraft manufacturers throughout the country.

Aerodrome ground panels, landing tees, mowers and rollers are also supplied, while a speciality is made of interior equipment and furnishing for offices and aerodrome buildings generally.

National Fire Protection Co., Ltd., Petersham Road, Richmond, Surrey.—Well known for their "Essex" methyl-bromide fire extinguishing equipment for aircraft installation, the National Fire Protection Co., Ltd., have turned their attention to ground equipment as well.

Prominent in this range are the "National" 100 and 300 gallons per minute water trailer pump unit; the "National" 400 gallons per minute mechanical "Airfoam" trailer pump unit; the "Essex" methyl-bromide portable trucks; and a comprehensive range of "National" first-aid surgical and crash equipment, in accordance with Air Ministry specification for civil aerodromes.

In addition, entirely new designs for aerodrome fire engines have been prepared, based upon practical operational experience. These large units, mounted on Fordson V.8 chassis, comprise combinations of "Airfoam," "Powder Foam," methyl-bromide and/or CO_2.

For the Marine Airport

THE term "airports" covers both land and land-sea alighting-grounds, and no review of airport equipment would be complete without some mention of the special liaison marine craft which some far-sighted boat-builders have designed.

The British Power Boat Co., Hythe, Southampton, whose high-speed craft for the R.A.F. are so well-known, offer a wide range of boats for marine and civil aircraft duties, ranging from small planing dinghies to a high-speed ocean-going reconnaissance launch for marine air base survey. To mention a few intermediate types, there is a general-service tender specially designed for rough-water work; the "S.P." Empire control tender for passengers; the "Sea" Tug" (a general-purpose craft for policing alighting and take-off areas, towing aircraft, transporting equipment, etc.); refuelling dinghies, and large and small crash rescue tenders.

Vosper, Ltd., Portsmouth, have in recent years specialised in the production of two types of marine craft for use in connection with flying boats or seaplanes. One is a 40ft. high-speed rescue or passenger tender designed in conjunction with the Air Ministry. It is of the planing type, possessing a high degree of seaworthiness and capable of a speed of 24 knots fully loaded; it is also suitable for general-purpose work, such as towing flying boats. The other Vosper craft is a 2,000-gallon refuelling tanker capable of 9½ knots with full load.

J. Samuel White and Co., Ltd., Cowes, are producing hard-chine craft in standard Admiralty types of 16ft., 25ft., 30ft., 35ft. and 45ft. boats, mostly powered with "White-Ford" engines, but other units can be fitted to suit any particular purpose or speed.

Workshop Equipment

Aerograph Co., Ltd., Lower Sydenham, London, S.E.26.—Spray doping and painting equipment of all kinds, including spray booths and exhaust fans.

Aerostyle, Ltd., 174, St. John Street, London, E.C.1.—Dope- and paint-spraying equipment.

Adamant Eng. Co., Ltd., Luton, Beds.—"Adamant" sparking-plug tester.

Air Industrial Developments, Ltd., Shenstone, Lichfield, Staffs.—Spray-painting equipment, air compressors, blow guns.

Aircraft Materials, Ltd.—Riveting equipment, etc.

Aviation Developments, Ltd., 29-31, Euston Road, London, N.W.1.—Riveting equipment.

B.E.N. Patents, Ltd., Gorst Road, Park Royal, London, N.W.10. — Spray-painting equipment, air compressors.

British Oxygen Co., Ltd., Thames House, London, S.W.1.—Welding equipment.

British Thomson-Houston Co., Ltd., Rugby.—Electric motors; air compressors.

Brook Motors, Ltd., Empress Works, Huddersfield.—Electric motors, including totally enclosed types.

Brooke Tool Mfg. Co., Ltd., Warwick Road, Greet, Birmingham.—Twist drills, chucks, tapping equipment, etc.

Broom and Wade, Ltd., High Wycombe.—Pneumatic drills, riveters, nibbling machines, compressors, etc.

Brown Bros. (Aircraft), Ltd., Great Eastern Street, London, E.C.2.—Hand- and machine-tool workshop equipment, maintenance jacks.

Burgess Products Co., Ltd., Barwell, Leicester.—"Acoustic-booth" telephone booth for noisy workshops, "Burgess-Noveto" vice.

Churchill and Co., Ltd., V. L., Walnut Tree Walk, London, S.E.11.—Valve lappers, maintenance tool kits, hydraulic presses, etc.

Consolidated Pneumatic Tool Co., Egyptian House, 170, Piccadilly, London, W.1.—Pneumatic and electric portable tools and riveting equipment.

De Bergue's Patents, Ltd., Strangeways Ironworks, Manchester. — Riveting equipment.

Desoutter Bros., Ltd., The Hyde, London, N.W.9.—Pneumatic and electric portable tools.

Duckham and Co., Ltd., Alexander, 16 and 18, Cannon Street, London, E.C.4.—Workshop lubricants, cutting oils, etc., of all kinds.

Dundas, Ltd., R. K., The Airport, Portsmouth (and Civil Aerodrome, New Delhi, India).—Maintenance stagings, jacks, trolleys, degreasing compounds, etc.

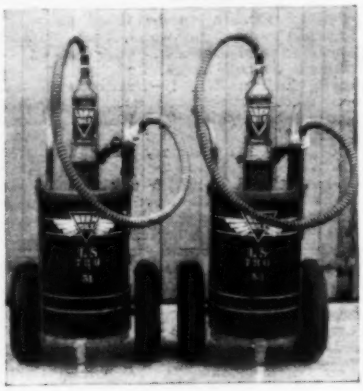
Equipment and Engineering Co., Ltd., 2 and 3, Norfolk Street, London, W.C.2.—"Magnaflux" crack-detector testing equipment.

Erlach, Ltd., Kurt, Sidcup, Kent.—Spray-painting equipment.

Felco Hoists, Ltd., 17, Victoria Street, London, S.W.1.—Rope and chain hoists for all workshop purposes.

Fletcher Miller, Ltd., Dukinfield, nr. Manchester.—"Cooledge" cutting oils.

Flexible Shaft Mfg. Co., Town Road, Edmonton, London, N.9.—Grinding, drilling and other tools with flexible drives.



"Germ oil" dispensing units as supplied to commercial aircraft operators at Heston and elsewhere.

Gilman (B.S.T.), Ltd., F., Carlton House, 195, High Street, Smethwick, Birmingham.—Grinding, polishing and other tools with flexible drives.

Gledhill-Brook Time Recorders, Ltd., Empire Works, Huddersfield.—Workshop time-keeping equipment.

Headland, Ltd., Thos. P., 164-168, Westminster Bridge Road, London, S.E.1.—General workshop tool equipment.

Hey Engineering Co., Ltd., Queen's Road, Coventry.—Machine tools for valve and cylinder operations, etc.

Incandescent Heat Co., Ltd., Cornwall Road, Smethwick, Birmingham.—All types of heat-treatment furnaces and baths.

Johnson and Sons, Ltd., C. H., Smedley Road, Manchester, 8.—Welding plant.

Johnson and Sons, K., Erskine Street, Leicester.—Workshop grinding equipment.

Lacy-Hulbert and Co., Ltd., Beddington, Croydon.—Air compressers and spray-painting equipment.

Laycock Engineering Co., Ltd., Victoria Works, Millhouses, Sheffield.—Dope-spraying plant, assembly stands, air compressors, degreasing tanks, con-rod aligners, etc.

Metropolitan-Vickers Electrical Co., Manchester. — Electric welding equipment, motors, etc.

Morris, B. O., Tythe Barn Lane, Shirley, Birmingham.—Grinding, polishing, drilling and other tools with flexible drives.

Myers and Co., S. J., 21a, High Street, Coventry.—Riveting equipment.

Newton Bros., Ltd., Cudworth, Yorks.—Boring jigs and other equipment for con-rod and bearing overhauls.

Northern Aluminium Co., Ltd., Bush House, London, W.C.2.—"Noral" aluminium paste, a protective finish for building materials.

Pillin, Ltd., John B., Beckenham, Kent.—Air compressors, lubricating equipment, blow guns, oil dispensing apparatus.

Ragosine Oil Co., Ltd., Woodhouse Lane, Leeds, 2.—Oils and greases, including cutting and quenching oils.

Ransomes and Rapier, Ltd., Waterside Ironworks, Ipswich.—Mobile cranes.

Rubery, Owen and Co., Ltd., Darlaston, Staffs.—Workshop storage equipment.

Silvertown Lubricants, Ltd., Minoco Wharf, London, E.16.—Oils and greases, including cutting, quenching and plant oils.

Stone and Co., Ltd., J. C., Chiswell House, 135, Finsbury Pavement, London, E.C.2.—Nibbling machines for sheet-metal cutting.

Constructional and Operational Equipment

British Oxygen Co., Ltd., Thames House, London, S.W.1.—Tyre inflation equipment.

Crimble of Staines, 10, London Road, Staines.—Agents for Fordson tractors, etc.

Colas Products, Ltd., Norman House, Strand, London, W.C.2.—"Colas" for the construction of runways, aprons, etc., and "Terolas" for aerodrome surface stabilisation.

Johnson and Sons, Ltd., C. H., Smedley Road, Manchester, 8.—Surfacing equipment for aerodrome construction.

Latil Industrial Vehicles, Ltd., 11, Albert Embankment, London, S.E.11.—Tractors for aerodrome construction and operation.

Pillin, Ltd., John B.—See under Workshop Equipment.

Ransomes and Rapier, Ltd., Waterside Ironworks, Ipswich.—Mobile cranes, aircraft docking cradles, launching catapults.

Short and Mason, Ltd., Aneroid Works, Walthamstow, London, E.17.—Meteorological instruments for airports.

Stream-Line Filters, Ltd., Hele-Shaw Works, Ingate Place, London, S.W.8.—Equipment for reconditioning aero engine sump oil for re-use.

Tecalemit, Ltd., Great West Road, Brentford.—Test-bed oil filters, bulk fuel filters, greasing equipment, etc.

Valor Co., Ltd., Erdington, Birmingham.—Indoor and outdoor oil storage and dispensing equipment, lubrication apparatus, fire extinguishers, etc.

Electrical Equipment, Miscellaneous

British Insulated Cables, Ltd., Prescot, Lancs.—Cables for all aerodrome electrical requirements.

British Thomson-Houston Co, Ltd., Rugby.—Mazda lamps for aerodrome floodlighting and for interior lighting; public address systems.

Brown Bros. (Aircraft), Ltd., Great Eastern Street, London, E.C.2.—Interior and exterior aerodrome lighting equipment.

Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C.4.—Cables for all aerodrome electrical requirements.

Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2.—Lamps for all exterior and interior lighting purposes.

Henley's Telegraph Works Co., Ltd., W. T., Holborn Viaduct, London, E.C.1.—Cables for all aerodrome electrical requirements.

Jobling and Co., Ltd., Jas., Sunderland.—Pyrex Dioptic floodlight lenses.

Troughton and Young, Ltd., 143, Knightsbridge, London, S.W.1.—Interior and exterior lighting installations.

Building Materials

B.B. Chemical Co., Ltd., Ulverscroft Works, Leicester.—"Bostik" compounds for sealing windows, cementing flooring, etc.

Cellactite and British Uralite, Ltd., Lincoln House, 269-302, High Holborn, W.C.1.—Cellactite roofing and walling.

Rubery, Owen and Co., Ltd., Darlaston, Staffs.—Constructional steelwork.

Finishes, Indoor and Outdoor

Berger and Sons, Ltd., Lewis, Homerton, London, E.9.

Cellon, Ltd., Kingston-on-Thames.

Docker Bros., Ladywood, Birmingham, 16.

Hall and Sons (Bristol and London), Ltd., John, Broadmead, Bristol, 1.

Kearsley and Co., Robert, Ripon, Yorks.

Llewellyn Ryland, Ltd., Balsall Heath Works, Birmingham.

Nobel Chemical Finishes, Ltd., Nobel House, Buckingham Gate, London, S.W.1.

Titanine, Ltd., Colindale, London.